SCIENTIFIC AMERICAN

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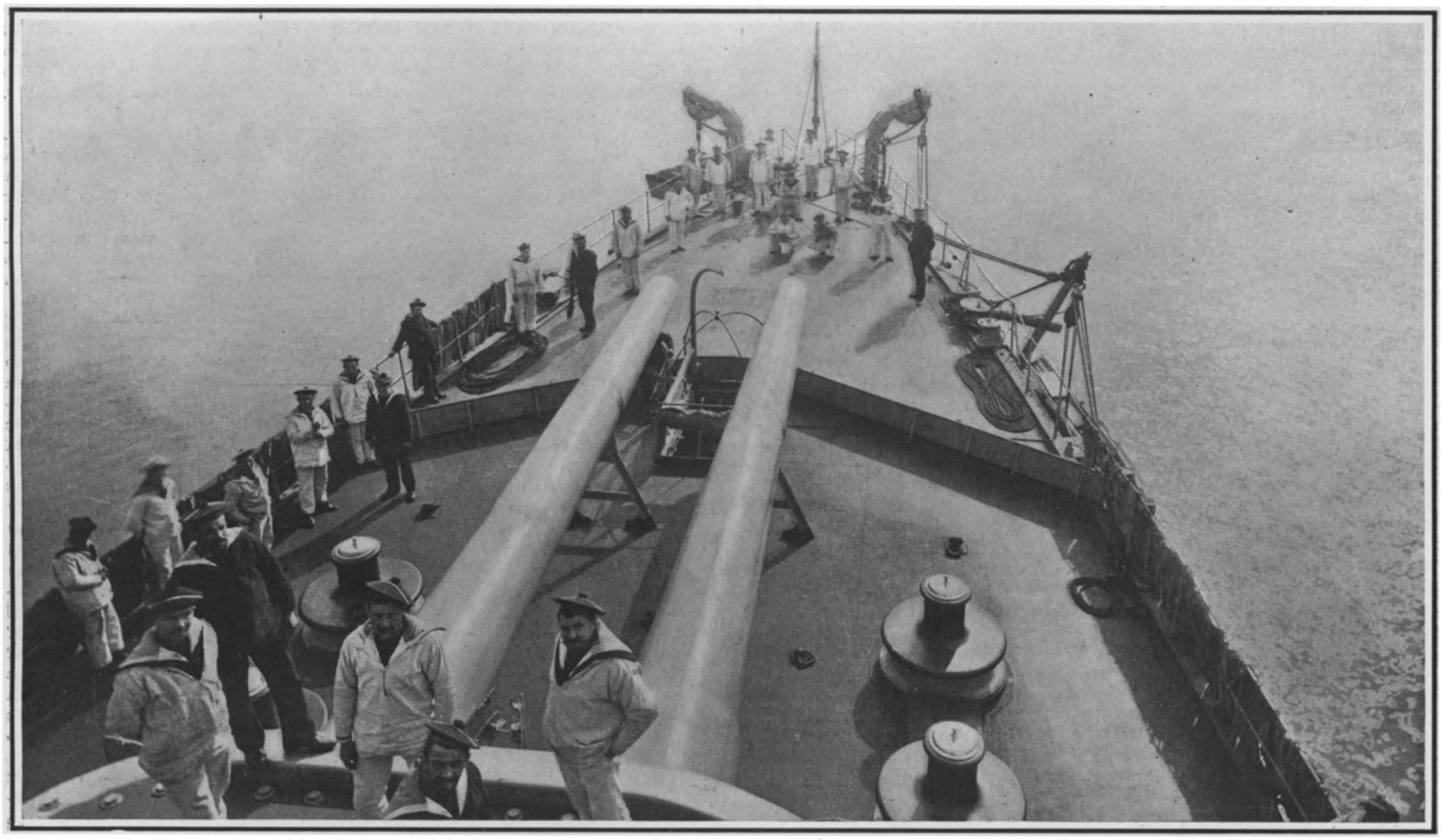
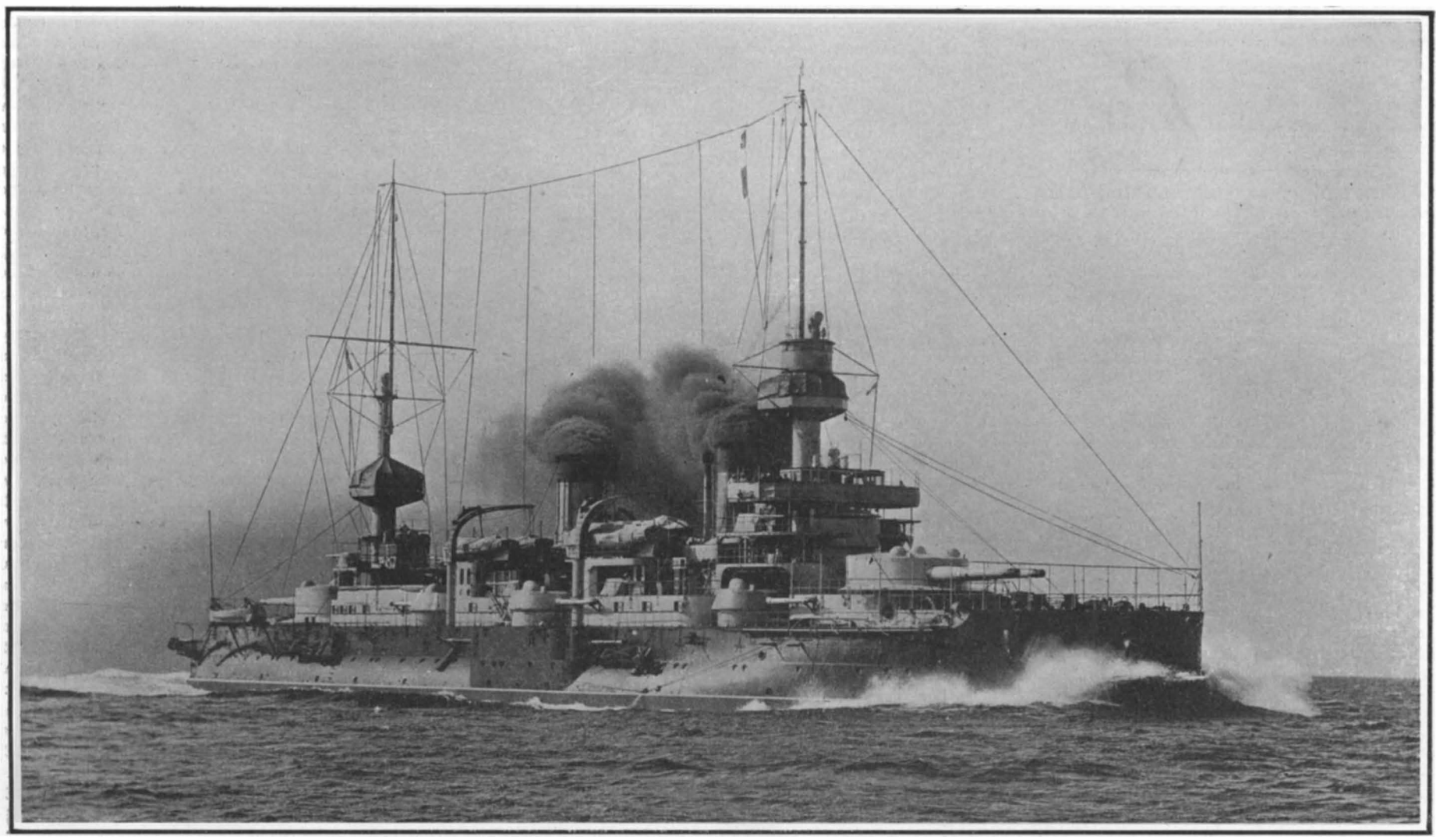
Vol. XCIX.—No. 12. ESTABLISHED 1845.] NEW YORK, SEPTEMBER 19, 1908. [10 CENTS A COPY $3.00 A YEAR.



These powerful guns are nearly 50 feet long; weigh 61½ tons; and fire a 926-pound shell with a velocity of 2625 feet a second. They can pierce 12 inches of Krupp steel at 5,000 yards.

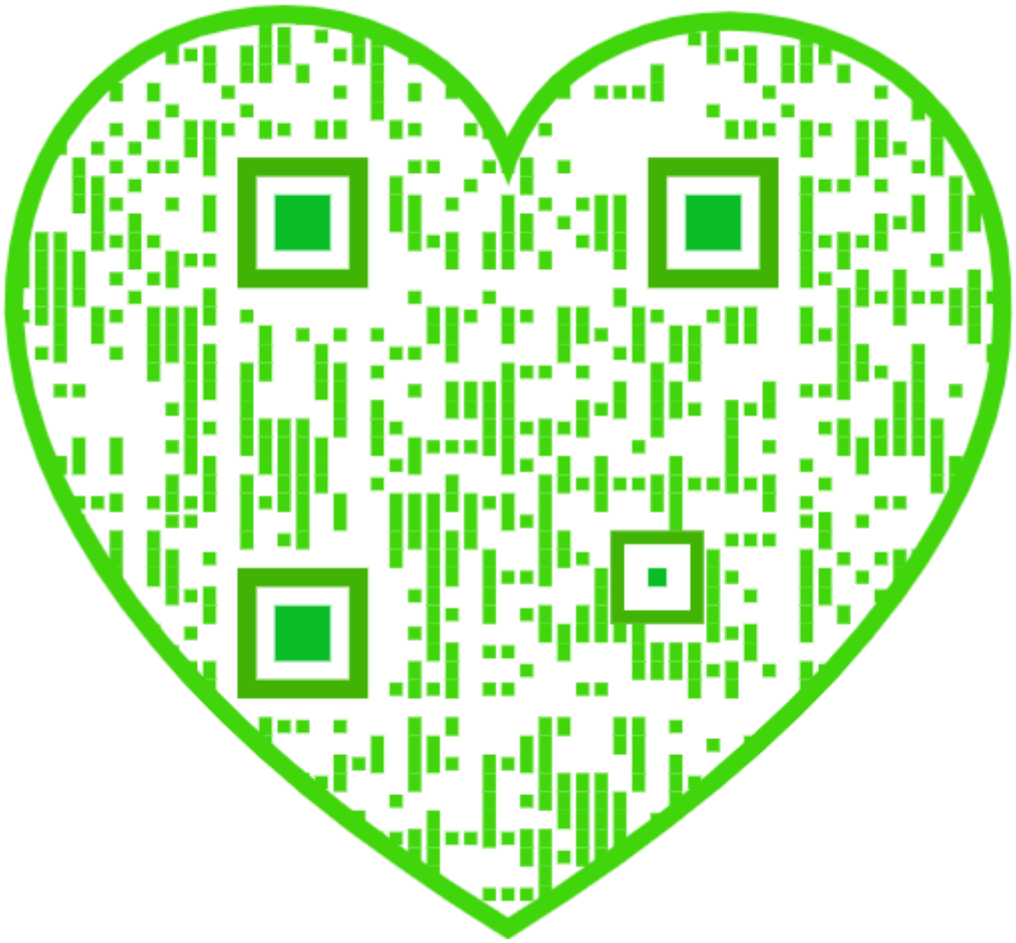
The 13.4-inch Bow Guns of the Battleship "Brennus."



Displacement, 12,750 tons: **Speed,** 18 knots; **Coal,** 1,150 tons; 60 tons oil. **Armor:** Belt, 12 to 9 inches; decks, 2¾ and 1⅝ inches; sides, 5 to 3 inches; turrets, 10 to 13 inches; secondary turrets, 10 to 5 inches. **Armament:** Four 45-caliber 12-inch; ten 45-caliber 6.4-inch; eight 4-inch; twenty-two small guns. **Torpedo tubes, 4. Complement,** 615.

Battleship "Suffren."

IV.—THE FRENCH NAVY OF TO-DAY.—[See page 187.]



SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York

FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845).... $3.00 a year
Scientific American Supplement (established 1876)..... 5.00 "
American Homes and Gardens ..... 3.00 "
Scientific American Export Edition (established 1878). ..... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, SEPTEMBER 19, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE REBUILDING OF THE QUEBEC BRIDGE.

In view of the widespread regret which was expressed at the fall of the Quebec bridge, the decision of the Canadian government to undertake the rebuilding of this monumental structure will cause general satisfaction. Following the report of the Royal Commission of Engineers, another body known as the Parliamentary Committee, which was appointed to look into the financial and political aspects of the situation, reported in favor of reconstruction. At its last session, it was decided by the Canadian government to assume all the assets and liabilities of the Quebec Bridge and Railroad Company, and proceed with the work of rebuilding.

It is safe to say that, outside of the foundations and masonry piers, no part of the old structure will enter into the new bridge. The cantilever which fell is to-day a mass of broken and badly-twisted steel. The other half of the bridge was so far advanced at the time of the disaster, that the whole of the material had been manufactured at the shops, and the greater part of it stored at or near the site. It is not likely that any of this material, amounting probably to about 20,000 tons, can be used. It is rumored that the work of designing and rebuilding will be placed in the hands of three leading bridge engineers, representing Canada, the United States, and Great Britain. Whether this be so or not, it will be a matter of great interest to observe how far, both in the outline and details of the new design, the lessons of the great disaster have been incorporated.

IMPROVED RAILS BY THE DRY-BLAST SYSTEM.

During the investigation of the methods of steel-rail manufacture which followed the frequent breakages of poor rails throughout the country, it was pointed out that one of the causes of imperfect ingots and rails was the moisture in the furnace air-blast. In the course of the discussion it was suggested that ingots of a better quality, free from pitmarks and blowholes, could be secured if dry air were used at the furnaces. Not long ago, the Illinois Steel Company, which has adopted the dry-blast system, turned out an order for 100-pound rails for the Lake Shore and Michigan Southern Railroad. The advantages of maintaining a constant and small degree of moisture in the blast were shown in the ingots, which, after being sawn in two longitudinally, were found to be comparatively free from pitmarks and showed marked solidity throughout. Surface blowholes were visible only at the top of the ingot, and what blowholes existed in the body of the ingot were free from surface oxidation. The improved ingots secure two great advantages in the process of rolling: a more uniform grade of steel being obtained in the finished rail, and the amount of cropping required being considerably less, under the same specifications, than that which is necessary when the ordinary air-blast is used.

PROGRESS IN THE GAS-DRIVEN SHIP PROBLEM.

Recent advices from Great Britain speak in optimistic terms of the results which have been obtained on the Clyde by the Beardmore Company, a powerful corporation which is investigating with great thoroughness the problem of driving ships by the producer-gas engine. As part of its experimental work it has installed a modified 500-horse-power Capitaine producer-gas engine and auxiliary plant in the obsolete warship "Rattler," a vessel of 715 tons displacement. The engine is of the vertical type, with five cylinders working on the Otto cycle. It is noteworthy that the gas-producing plant is arranged to work with bituminous coal. The gas is cooled and cleaned by passing it through a scrubber, and is drawn off by the engine in proportion to the work that is being done. The exhaust gases are utilized in a boiler for raising the steam necessary in the operation of the producer. Power is transmitted to the propeller shaft through a special type of hydraulic clutch, the speed of the engine, when it is disconnected, being controlled by a suitable governor. For reversing, the power is transmitted to the propeller shaft through a train of wheels operating in combination with the clutch. The economy of weight in this installation is shown by the fact that whereas the original steam machinery weighed 150 tons, the complete gas-producer plant with its auxiliaries weighs in the total only 94 tons. During a series of trials the vessel covered 31 miles at a speed which, after tide corrections had been made, worked out at 12.8 knots per hour. The coal consumption, as compared with that of a steam engine of the same power, showed an economy of fifty per cent. We understand that the next experimental engines will be of 1,000 horse-power.

MORE POWERFUL EXPRESS LOCOMOTIVES.

The continued increase in the weight of express passenger trains, and the consequent demand for locomotives of greater hauling power, have been met by locomotive builders in the production of express locomotives of a weight and power considerably greater than are to be found in the railroad systems of Europe. The limit of hauling power is determined by the load which can be carried upon the driving wheels, and this, in the case of the heaviest express locomotives, had been increased to the high figure of about 90 tons. The maximum number of driving wheels among which such a load can be distributed under the present type of locomotives is six. Any larger number of drivers would involve too rigid a wheel base. Designers are, therefore, confronted in passenger service with the same difficult conditions which, in freight service, led to the introduction of the Mallet system, in which the total load on the drivers can be greatly increased without increasing the maximum loading on any single pair of wheels. Designs have lately been drawn for an express passenger engine to be built on the Mallet system, in which the total weight on the driving wheels will be nearly 120 tons, distributed among eight 73-inch driving wheels. Four of these are placed beneath the firebox of the locomotive, and are driven by two high-pressure cylinders; the other four are carried in a forward truck, and driven by a pair of low-pressure cylinders. It will thus be seen that the introduction of this type for fast passenger service has increased the adhesive weight over thirty per cent. If the new type satisfies the various other requirements of an express locomotive, this departure will mark one of the most important advances yet made in the express service of this country. The greater hauling power may be used either in the acceleration of existing trains, or in the increase of the number of cars hauled. Many trains which are now run in two sections may be made up as a single train, a change which will afford much-needed relief on heavily congested lines.

FUTURE SPEED OF CRUISERS.

The transatlantic speed of the "Indomitable" on her return trip from Quebec, which is stated officially to have been 24.8 knots from land to land, and 25.13 knots for three consecutive days of ocean steaming, has set a mark which is certain to have a powerful influence upon the design of future warships. Had this speed been shown by a cruiser scout crammed with coal, boilers, and machinery, and armed with only a few light rapid-fire guns, the speed, though notable in itself, would have exercised no controlling influence on fighting-ship design; but when we bear in mind that the ship which made this 25-knot run carried from 7 to 10 inches of Krupp armor and mounted eight of the most powerful 12-inch guns afloat, the speed takes on tremendous significance. The presence of the "Indomitable" on the high seas has upset all existing calculations as to the value of the armored cruiser, just as the appearance of the armored cruiser in its day relegated the protected cruiser to a subordinate position, and ultimately to the scrap heap. For it is certain that a single "Indomitable," able to carry its 12-inch guns for such great distances at such high speed, could catch and destroy the most powerful existing armored cruisers of the day. For the future, 25 knots must be the mark of all the warships which, by virtue of their carrying medium armor, will belong to the armored-cruiser class. One effect of this will be to increase enormously the cost of the cruiser and, to no little degree, her size. In fact, the "Indomitable" has raised the cost of cruiser construction, as the "Dreadnought" did that of the battleships.

THE MAKING OF AEROPLANE HISTORY.

Hardly had Delagrange made record flights of 29 minutes and 54 4/5 seconds on September 5 and 31 minutes on September 7, when Orville Wright outdid him. In four of the most daring aeroplane flights of our time, Mr. Wright gave not only a wonderful exhibition of personal skill in handling a sensitive aerial craft, but also considerable assurance that the day of the military scouting aeroplane is not far off. On September 9 he flew for 57½ minutes in the morning and 1 hour and 2¼ minutes in the afternoon, concluding his day of records by making a flight lasting 6 minutes and 26 seconds with Lieut. Lahm on board. On September 10 he made a flight lasting 65 minutes and 52 seconds in a 12-mile wind; and on September 11 he remained in the air 1 hour, 10 minutes and 32 seconds at a height of 200 feet, alighting only because of increasing darkness. During all these flights the machine responded admirably to the touch of Mr. Wright.

In the face of these remarkable achievements, Mr. Wilbur Wright's flights in France, startling though they would have been only a few months ago, seem completely eclipsed. Yet on September 5 he flew for 19¾ minutes at an average speed of 37 miles in a four-mile wind, which is his best performance in France.

That either of the Wright brothers can fulfill the government's requirements seems indisputable in the face of these historic flights.

DOUBTFUL CASES OF RADIOACTIVITY.

Recently Cosmos published an article on "the radioactivity of leaves of conifers," in which allusion was made to the experiments of Dr. Russel, who obtained in total darkness impressions on photographic plates placed near or in contact with various parts of conifers. Dr. Russel has since obtained similar impressions from leaves, flowers, seeds, stems, and tubers of many plants. No effect, however, is produced by starch, cellulose, gum, sugar, pith, or pollen. The exposure varies from a few minutes to more than 18 hours. The action is accelerated by heat but the temperature should not exceed 130 deg. F. As moisture injures the gelatine film, the leaves, etc., should be partially dried by laying them between sheets of blotting paper and subjecting them to a pressure of from 5 to 25 ounces per square inch. This method has the advantage of furnishing two images, one taken from the dried leaf and the other from the blotting paper impregnated with the expressed sap, which also possesses power to affect the photographic plate.

Most leaves give well-marked images, the strongest being produced by leaves full of sap. Complete desiccation greatly diminishes or entirely destroys the effect. The action is distributed irregularly over the surface of the leaf. Faint impressions have been obtained from leaves that had been pressed between blotting paper for three years. In such cases the effect is increased by moistening the dried leaf. An incision made in a dried leaf shows very conspicuously in the image, as if a peculiarly active emanation had flowed from the cut edges.

Petals of various flowers also produce strong impressions. They should be partially dried between blotting paper, which gives a second image, as in the case of leaves. The color of the petal has no influence on the result. White and red rose leaves, yellow, blue and purple petals of pansies, appear to possess equal powers of impressing the plate. Petals appear to be more active than leaves of the same plant.

The pistils and stamens of several plants produce strong impressions but the extracted pollen exerts no appreciable action.

The cotyledons of beans are inactive, both before and after germination. The plumule and radicle, on the contrary, become active when they have grown about an inch. The outer coat of the skin is inactive but the inner coat strongly affects the photographic plate. The expressed juice of young bean plants about 7 inches high is very active. Grains of wheat become active after remaining two days in moist sand. It appears probable that the sap of young plants of all grains, even when they have sprouted and grown in complete darkness, possesses great activity. Similar results have been obtained with acorns, almonds, peas, and various nuts. The oil of nuts, however, becomes very active on oxidation. Paper saturated with the oil by pressure and exposed to the air soon acquires a marked power to impress photographic plates. Oil extracted from nuts with ether is also very active. Castor oil, on the contrary, remains inactive after months of exposure to the air.

In bulbs, the fleshy parts are active but the nucleus is inactive until it has begun to grow. The expressed juice of potatoes is very active, that of Jerusalem artichokes slightly active. The activity of bulbs and tubers is destroyed by drying.

The activity of rhizomes, or root-stocks, varies greatly with the species, and probably also with the season. It is slight in the iris and well marked in ferns. Roots possess considerable activity.

The woody envelope of some fruits appears to con-

tain two substances, one of which is active, the other not. Usually the activity is confined to the darker and inner layers. The concentric layers of the axis of the pineapple vary greatly in activity. Almond shells are totally inactive.

What is the cause of these various phenomena? Evidently it is not radioactivity, for the action is entirely prevented by the interposition of a sheet of glass or mica between the object and the photographic plate. Dr. Russel conjectures that the effect is caused by hydrogen dioxide. A solution of one part of hydrogen dioxide in one million parts of water produces an appreciable effect on a photographic plate in 24 hours in darkness, even when the layer of liquid is ⅛ inch distant from the plate. According to Usher, Priestley and many other investigators, hydrogen dioxide and formaldehyde are the first products of the growth of plants. These facts explain the action of growing plants on the photographic plate. Furthermore, hydrogen dioxide is generated by turpentine and other resins, which occur in many plants. The subject, however, requires further investigation.

A FEW FACTS ABOUT FAKES.

BY J. F. SPRINGER.

About 1769 Baron Kempelen of Hungary began to astonish the civilized world of Europe with his chess player. This was apparently a figure controlled by mechanical devices, and which was able, notwithstanding the fact that apparently no intelligence was concerned in its movements and decisions, generally to beat its human antagonists. The cabinet connected with the automaton appeared entirely too small to contain a hidden operator. And yet it did conceal a man who was an expert chess player. He was a Polish patriot who had lost both of his legs—perhaps in the recent war over Poland. This man, Woronsky by name, was an expert player. With him hidden in the cabinet and yet really on the spot, the rest was easy.

The career of George Psalmanazar—as he called himself—was one of the most astonishing on record. This man was born in Switzerland or France, but during the time of his "fame" claimed to be a native of the island of Formosa. He had acquired a moderate education, but seemed indisposed to employ himself in any regular occupation. Instead, he roamed over Europe, serving with the Dutch and with the German army. At one time he pretended to be an Irishman, at another an unconverted Japanese, at a third time as a converted Japanese. In the last capacity he deceived the colonel of a British regiment at Sluys. The chaplain of the regiment—a man named Innes—however, did not seem to have been deceived. He and Psalmanazar proceeded to England, and there began a marvelous career. Psalmanazar masqueraded as a genuine native of Formosa converted to Christianity. The clergy received him with open arms. He had an interview with the Archbishop of Canterbury, who, however, was unable to understand his Latin. But then, who would expect a Formosan to speak Latin with perfection? He published an invented Formosan alphabet, together with forged examples of the native language, accompanying them with translations. The Bishop of London seems to have believed implicitly in his claim to know the language of Formosa, for he employed Psalmanazar to translate the Church catechism into it. He was sent to the University of Oxford to finish his education. There he is said to have employed his waking hours in an idle way, but to have left a candle burning while he slept to bear witness of his zeal in scholastic pursuits. He wrote a treatise upon Formosa in Latin. When this was translated into English, it had a very large success. To corroborate his claim of being a native Formosan, he would eat raw meat, roots, and herbs. He was lionized, and was immensely successful. Although he carried on the deception with the greatest ingenuity, deceiving great and small, he tripped at last. In an unwary moment he joined with someone in exploiting a "white Formosan ware." This led to his downfall. Detection being imminent, he confessed. This is one account. Another has it that he became conscience-stricken, and voluntarily withdrew from the public gaze.

A self-educated man of humble origin of the name of Vrain Lucas, ignorant of both Greek and Latin, became the prepetrator of a fraud involving the preparation of 27,000-odd forged documents, many of them purporting to be letters written by celebrated historical personages. Although written in *French*, they purported to be letters from Sappho, Thales, Dante, Petrarch, Julius Cæsar, Alexander the Great, St. Luke, Shakespeare, Lazarus, Newton, Pascal, Cleopatra, and others. M. Chasles, the great mathematician, was apparently ready to believe that all the ancients were proficient in this language, for he was completely fooled by Lucas. In 1867, among other documents Lucas communicated to the Académie through Chasles two letters and four notes purporting to have been written by the celebrated French mathematician and thinker, Blaise Pascal (1623-1662). If these letters had been genuine, they would have proved him to have anticipated Newton (1642-1727) in his great discovery of the law of gravitation. Chasles was attacked, but stood his ground, even producing other letters to bear him out—from Pascal to the boy Newton. The discussion lasted for two years. In 1869, the Académie made an official declaration in favor of the genuineness of the letters. France went wild. The people in the street cheered the name of Pascal. But shortly afterward an official of the Observatory pointed out that sixteen of the Pascal letters were to be found in Saverien's "History of Modern Philosophers," which had appeared a century before. But M. Chasles claimed that Saverien had used them without acknowledging his source. And so it went. But Le Verrier demolished the whole fabric of the fraud. Lucas was finally brought to trial, convicted, and sent to prison for two years. He had realized, however, about $30,000 from his activities.

Simonides was a past master in the art of literary forgery. His performances belong to approximately the same period, but were accomplished on different soil. His greatest achievement was the forgery of a history of ancient Egypt written in Greek by Uranios. This he proposed to sell to the Germans for a great sum. In order to understand just what a marvelous piece of work he produced, it will be necessary to understand some of the difficulties. He undertook to produce a palimpsest—that is, an old parchment manuscript which has been used again for a more modern work. He took a manuscript of about the twelfth century, and wrote his history on the same parchment. As this new writing was to masquerade as the older, he had to avoid getting a single line of the new upon any part of the old. This required wonderful care, as there was really but very little space. In addition, he had to make the Greek letters he used agree with the style of the century they were supposed to represent. Of course, the history itself and the character of the language had to correspond with the supposed period of composition. As Prof. Max Müller tells us, he followed Bunsen's "Egypt" and Lepsius's "Chronology." And so the finished fraud captivated Lepsius, great scholar that he was, for the dates were all correct, that was plain to be seen! However, the manuscript had to undergo a very searching investigation, which included chemical and microscopic tests. Dindorf, the great classical editor, was to edit it for publication, and the Clarendon Press of Oxford was to publish first specimens. In fact, the fraud had almost been accomplished, when unfavorable news began to be received in Germany—probably accounts of Simonides's previous doings. At any rate, a re-examination was made, and inconsistencies in connection with the Greek letter M were found. In addition, a single passage was discovered where the supposed older ink was in reality seen to have run across the twelfth century writing. This was conclusive.

One of the most astonishing examples of genius devoting itself to forgery was that of the Italian Bastianini. Born in 1830 in the midst of abject poverty, he had, properly speaking, no systematic education, either literary or artistic. But he had real genius. An antiquarian of the name of Freppa employed him for two francs per day to produce "antiques" which might be sold at a good profit. So this became Bastianini's life-work—the production of forgeries. One of his most celebrated works is the bust of Savonarola. Persuaded that here was a real fifteenth century bust, two public-spirited gentlemen collected 10,000 francs, and purchased it from Freppa to prevent its sale and exportation. One critic, Dupré, declared that he must assign it to Michelangelo for its force and to Robbia for the exquisiteness of its treatment, regarding it as a wonderfully beautiful work of art. Sir Frederick Leighton, the noted English painter, having received a photograph, placed it, "like a sacred image, at the head of his bed." It is said that the Grand-duchess Marie of Russia and Lippart seriously thought of building a temple to house this wonderful bit of art. But, notwithstanding the plaudits of those who "knew," the bust was a fake. Rumors having become current that the piece of terra cotta was not what it purported to be, one of the purchasers abruptly demanded of Bastianini one day at his workshop whether he was the creator of the bust. And he admitted that he was. But this was not the only great "success" of Bastianini. A terra-cotta bust of Benevieni, a sixteenth-century poet of Florence, was regarded as a contemporary work of art, and purchased by the Louvre for 13,000 francs, and installed in a room containing work of Michelangelo himself. But it was a fake for all that.

In the late nineties an English magazine was founded with the avowed object of printing true tales of adventure and the like. One day a man calling himself Louis de Rougemont handed a letter of introduction from a member of Parliament to the editor. The stranger told a harrowing tale of a life spent in Australia with cannibals in an unexplored region of that continent. Rougemont was proof against the most merciless cross-examination. He never contradicted himself. His narrative was taken down in shorthand, and published serially in the magazine. The editor introduced Rougemont to scientists, confident that the experiences of the man were of value to geography and anthropology. Two eminent geographical experts heard his story, tested it from their wide and accurate knowledge, and risked their reputations by giving it full credit. They too were of opinion that it contained matter of especial importance to science. The British Association for the Advancement of Science began to be officially interested. Arrangements were entered into for the appearance of the hero before it at the Bristol meeting.

Rougemont told a truly staggering tale. He enriched it with lively details of a fight with an octopus, of a wreck from which he was saved by a swimming dog to whose tail he clung, of an island on which he landed and where he lived on turtle meat and rode on turtles as if they were horses, of a visit of four starving blacks, one of whom, a woman, he married and to whom he even dedicated his astonishing narrative, and of his leaving the island to become the ruler of an Australian cannibal tribe for thirty years.

Long before the magazine had completed the story, Rougemont was found to be a faker. His biography was fiction. He had, however, deceived for a considerable time a great mass of people, many of whom knew Australia, and some of whom were experts in the branches of knowledge having to do with the alleged facts.

The Louvre in Paris is both the largest and the finest collection of examples of art that exists anywhere in the world. And yet this great museum of art has been made within recent years the victim of a striking piece of forgery. There was submitted to its inspection and approval a wonderful example of the goldsmith's art. This was claimed to be the tiara of Saitapharnes, and to have been dug up in southern Russia. The Louvre paid £4,000 for the headpiece. Henri Rochefort, the noted editor of L'Intransigeant, branded the headpiece as a forgery. It is possible that he did not act entirely independently, although he was an expert in art matters. To support the allegation of fraud, there was brought to Paris a certain M. Koukhomovski, a goldsmith of Odessa. Arrived in Paris, he demonstrated that he could indeed execute work the equal of the tiara. The upshot of it all seems to be that the tiara was partly genuine, but otherwise to have been the work of the accomplished M. Koukhomovski.

THE CURRENT SUPPLEMENT.

A new system of ship construction has been devised by J. W. Isherwood, which gives a freight-carrying vessel greater capacity than has been possible under the old construction. The system is painstakingly described and illustrated by the English correspondent of the SCIENTIFIC AMERICAN in the current SUPPLEMENT, No. 1707. Dr. Louis Bell reviews recent American work in power transmission. A. Troller contributes an article on the Armengaud system of electrical vision at a distance. Our Berlin correspondent describes an air-driven typewriter. The dredging equipment on the Panama Canal is a subject discussed by F. B. Maltby. A new type of automobile road-roller is described and illustrated by the Paris correspondent of the SCIENTIFIC AMERICAN. How Prof. Onnes of Leyden liquefied helium is excellently set forth by Francis Hyndman. Prof. D. Finlayson, the well-known English agricultural authority, writes on barley and its cultivation. "What is the good of astronomy?" is no doubt a question which the layman frequently asks himself. That question is very fully answered by Prof. Harold Jacoby. The Commissioner of Fisheries contributes a simply-worded article on the transplanting of fish.

THE MOREHOUSE COMET OBSERVED.

The new comet discovered upon a photographic plate by Mr. Morehouse at the Yerkes Observatory on September 1 has been observed visually with the 10-inch refractor at Smith Observatory by W. R. Brooks. On September 5, 14h. 20m. standard mean time, the position of the comet was right ascension 3 hours 20 minutes; declination north, 68 deg. 30 min. On September 7, 15 hours 30 minutes, the comet's position was R. A. 3 hours 00 minutes; declination north, 69 deg. 30 min.

The discovery place on September 1, 361 G. M. T., was R. A. 3 hours 20 min.; declination north, 66 deg. 15 min. These several places show a slow motion of the comet in a northwest direction.

The comet is visible in a small telescope, being an easy object in the 3-inch finder of the equatorial, and promises to become an interesting object as it comes nearer.

The comet is now just under the back of Cassiopeia's Chair, and being circumpolar is observable all night when the moon is absent.

RECONSTRUCTION OF THE BALTIMORE & OHIO BRIDGE OVER THE SUSQUEHANNA RIVER.

BY DAY ALLEN WILLEY.

The great development which has taken place during the past decade in the freight and passenger business of the leading railroads has made it incumbent upon them to undertake works of reconstruction and enlargement often upon a truly enormous scale. It has been no unusual occurrence, of late years, for a leading trunk road to spend from fifteen to thirty million dollars merely upon the improvement of its existing roadbed and structures. This work includes the relocation of the lines for the purpose of reducing grades and cutting out curvature; the rebuilding of roadbed structures; and the entire reconstruction of bridges. This last work, particularly where broad and deep rivers are spanned, is very costly, and especially so in cases where the existing bridge makes provision for only a single track, since then it becomes necessary, not merely to build a bridge of greater weight and strength to accommodate heavier locomotives and rolling stock, but the tracks have to be at least doubled, with a corresponding increase in the labor and materials entering into the new bridge.

The accompanying illustrations represent the reconstruction of one of the longest and most important railroad bridges in the country—the crossing of the Susquehanna River by the Baltimore & Ohio Railroad. The river, at this point, calls for a bridge of about 7,000 feet total length, which, indeed, is the length of the old single-track bridge measured from abutment to abutment. In the center of the river is an island or shoal known as Watkins Island, which is dry throughout the greater part of the year, but is usually submerged during periods of high water. The channels on each side of Watkins Island are spanned by truss bridges. The west channel structure is a through truss, and that on the east channel a deck truss. The approaches and that portion of the crossing which extends across Watkins Island are carried upon steel bents resting on masonry pedestals, the superstructure consisting of plate girders of a span of 30 feet. The crossing of the easterly channel is spanned by a deck truss in which the tracks are carried above the upper chord. That portion of the river between the westerly channel and the westerly abutment in the old bridge is spanned by four long deck trusses.

In the reconstruction of the bridge it was decided to discard the old structure altogether, and build an entirely new bridge throughout the whole length of the crossing. The magnitude of this work will be appreciated when we state that in the whole 7,000 feet of bridgework there will be no less than 20,000 tons of steel. The difficulty of the work is increased by the fact that not only is the bridge to be made of more than double the capacity, providing for two tracks in place of one, and enabling these tracks to carry loads far in excess of those for which the old bridge was designed, but this 20,000 tons of steel must be assembled, hoisted into place, and riveted together, without any interference with the heavy traffic which passes daily over this road.

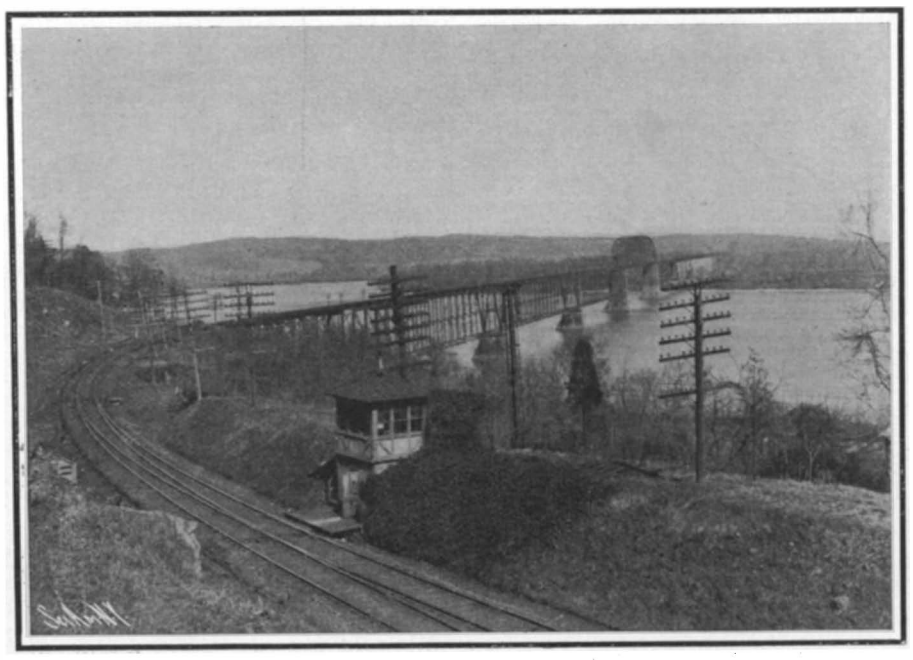
In the reconstruction of the plate girder viaduct portion of the bridge on Watkins Island and in the approaches it was decided to substitute concrete piers for the old steel trestle work and to greatly enlarge the spans, using 90-foot girders in place of the old girders of 30 feet span. In doing this work new concrete piers were built beneath every third span, their location falling, therefore, clear of the existing steel bents. The top of the piers falls considerably short of the base of the old girders, the increased clearance being necessary to accommodate the greater depth of the 90-foot plate girders of the new structure.

Of course, the most important and difficult part of the work is the reconstruction of the through steel trusses 520 feet in length across the deep water channel. The falsework for carrying these trusses during construction consists of temporary timber piers, resting on piling driven into the bed of the channel, and spanned by four lines of deep plate girders. The great span over the westward navigable channel will have a clear length between end pins of 520 feet, and another span of the same length will be thrown across the east channel between Watkins Island and the east approach. The truss over the western channel will be a deck truss, that is to say, the tracks will be laid through the truss at the level of the lower chords. The truss over the easterly channel will be a deck truss with the tracks laid upon a floor system resting upon the upper floors. The distance between the westerly piers of the westerly channel truss and the west approach will be spanned by four deck trusses, each 480 feet in length. There will be a clear height of navigation of 90 feet between the under side of the westerly channel span and the water.

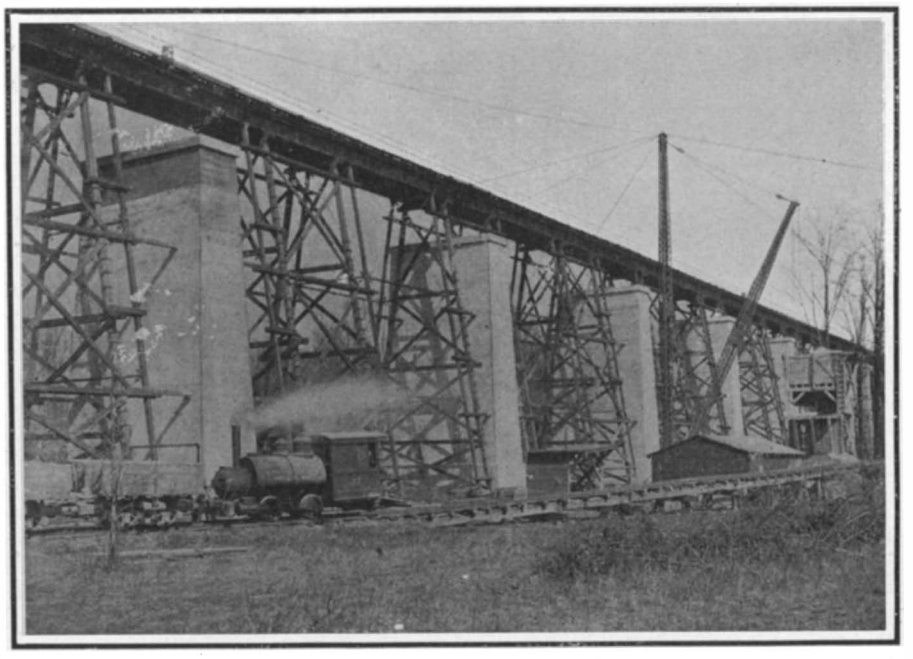
Ordinarily, the depth of water in the west channel ranges from 20 to 25 feet, while the depth in the east channel reaches, in some places, 55 feet. These depths, however, are liable to be increased in the flood season by from 20 to 25 feet. In some parts of the crossing it has been necessary to go down a distance of 80 feet to reach the rock bed; while in the east channel the rock is over 100 feet below the surface of the water when the river is at flood.

Fully three years must pass before the bridge is ready for service. When it is completed it will rank as one of the notable bridges of the world.

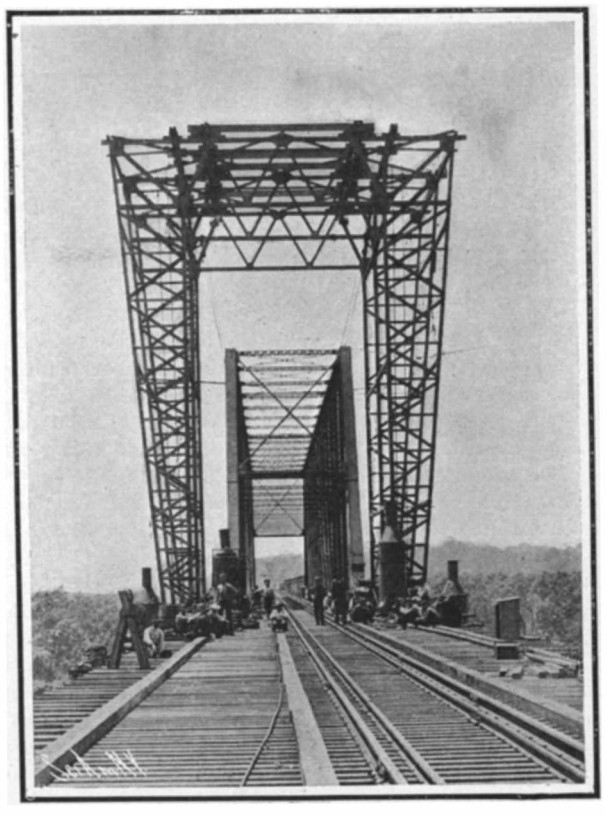
The Susquehanna Bridge is one of a series which is being erected as part of the reconstruction of portions of the Baltimore & Ohio system, and in this work are included several stone arch bridges which are notable for their massive proportions, ranking in this respect with some of the famous masonry bridges of Europe. The conception and carrying out of the new bridge is due to Mr. D. D. Carothers, chief engineer of the Baltimore & Ohio system. Mr. A. M. Kinsman, bridge engineer of the road, is in charge, with Mr. J. T. Wilson as supervisor.



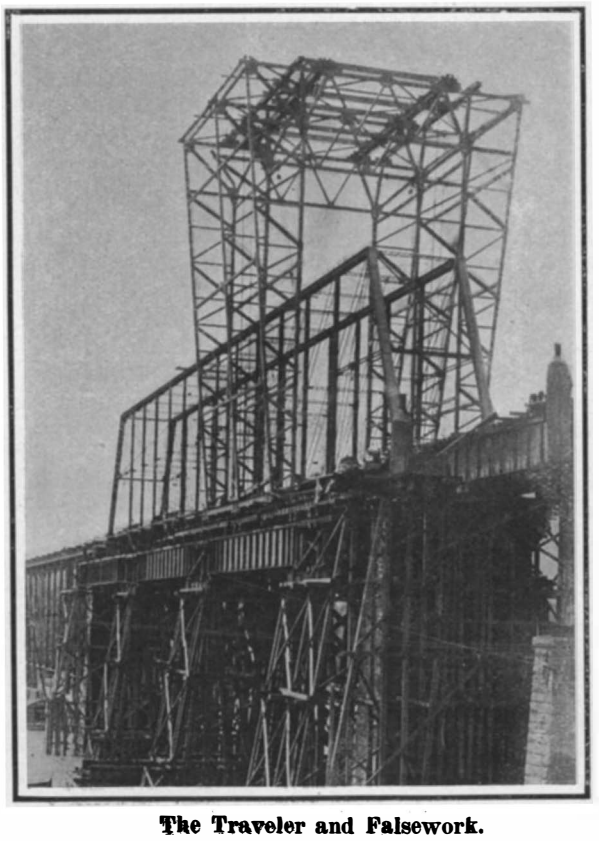
General View of the Bridge.



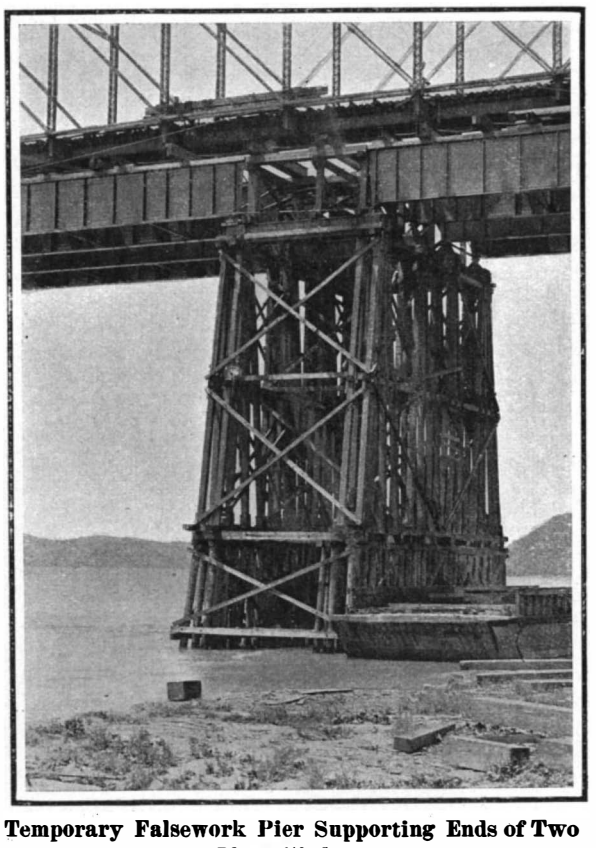
View Showing Old Bridge and New Concrete Piers.



The Traveler Used in Erecting the Trusses.



The Traveler and Falsework.



Temporary Falsework Pier Supporting Ends of Two Plate Girders.

RECONSTRUCTION OF THE BALTIMORE & OHIO BRIDGE OVER THE SUSQUEHANNA RIVER.

THE COLLINS SYSTEM OF LONG-DISTANCE WIRELESS TELEPHONY.

The longest distance wireless telephone tests yet made on this side of the Atlantic have just been completed between Newark, N. J., and Philadelphia, Pa., a distance of eighty-one miles, as wireless waves travel.

The system by which this has been accomplished is due to A. Frederick Collins, a pioneer in the wireless telephone field. The first of his series of tests took place between his laboratory in Newark, where he has a high-power sending station, and the Singer Building in New York city, about twelve miles away, on the night of July 9, when spoken words were clearly and loudly transmitted across the intervening space. The following day the distance was increased to thirty-five miles, when the receiving station was located at Mr. Collins's country home at Congers, N. Y., and then, amplifying the power of the sending station and bringing the instruments into sharp resonance, the Newark-Philadelphia tests were made the following Tuesday at midnight, from the top of the Land Title Building.

This system of wireless telephony is the culmination of work begun by the inventor in 1899, and in its modified and present form it consists of an apparatus for generating continuous oscillations and an instrument for reconverting the received oscillations into audible, articulate speech. For the overland tests the initial energy employed was a direct current at 500 volts furnished by the Newark Public Service Corporation. This was increased to 5,000 volts by a direct-connected motor-generator set, the dynamo of which was especially designed by Mr. Collins to stand high-potential strains.

The latter current was used to energize a self-regulating arc lamp having revolving electrodes instead of the usual induction coil employed in spark telegraphy. A blow-out magnet was adjusted at right angles to the oscillation arc, and one of the ends of the magnet was placed in series with the positive wire, and the other coil in circuit with the negative wire. This magnet fixes the arc in the best position; besides the coils serve to choke back the oscillations from the high-tension generator. Across the 500-volt direct-current circuit, the terminals of a small transformer coil are shunted, but a condenser is interposed to check the high-voltage direct current from flowing through it. The primary of the transformer is connected in series with a source of current developing 25 volts direct current and a telephone transmitter.

From the opposite sides of the arc the oscillation circuit leads off, and is completed by a battery of glass plate condensers on either side of the tuning induction coil. The choking effect of the induction coil causes the potential difference of the oscillations to be greatest on either side of the coil. Hence the aerial and ground wires are placed on opposite sides of the coil at the point where resonance is a maximum. An auto-transformer in the aerial serves further to step-up the potential to 100,000 volts or more of the oscil-

The Thermo-Electric Detector Taken Apart.

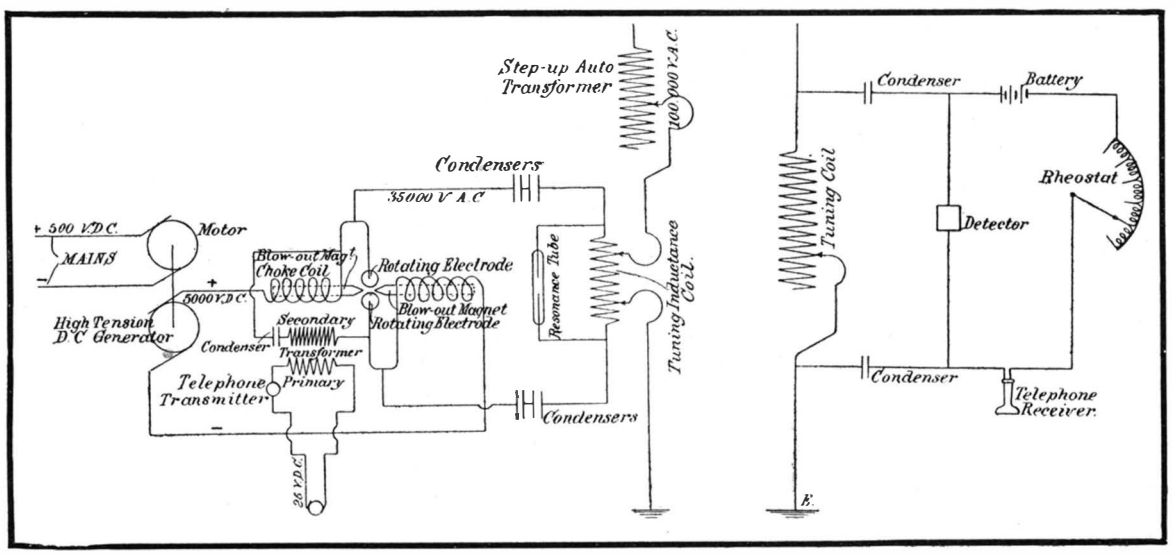
lations surging through it. Not the least important, though a subsidiary piece of apparatus, is the resonance tube devised by Mr. Collins for the instant visual determination of the proper values of induction and capacity of the closed circuit, as well as when this latter circuit is in tune with the aerial wire system. The device consists of an exhausted glass tube 13 inches in length and 1¾ inches in diameter. Sealed in the ends are platinum wires 1/16 inch in diameter, and these extend longitudinally through the center of the tube until the ends almost touch each other. The outside terminals are connected in shunt with the induction coil. Now, when the first feeble oscillations begin to surge in the closed circuit, one or the other will glow, or both of the free ends of the inclosed wires will glow, depending on the oscillatory nature of the current. As the current strength of the oscillations increases the glow-light extends farther and farther toward the ends of the tube, but always keeping close to the oppositely-disposed wires.

The length of the glow on the wires is proportional to the current strength, and thus the tube may also be used as a measuring apparatus instead of the milammeter usually employed. The characteristics of the oscillations can also be easily observed; for if they are positive the light will appear almost wholly on the end of one of the wires, and if the current is reversed, on the opposite end; while if the current is oscillating with equal electro-motive forces, the light will have the same degree of intensity on both wires. By means of a revolving mirror the oscillations may be segregated, and it is then easy to see whether they are periodic or continuous, and if the latter, to analyze the wave form of the spoken words.

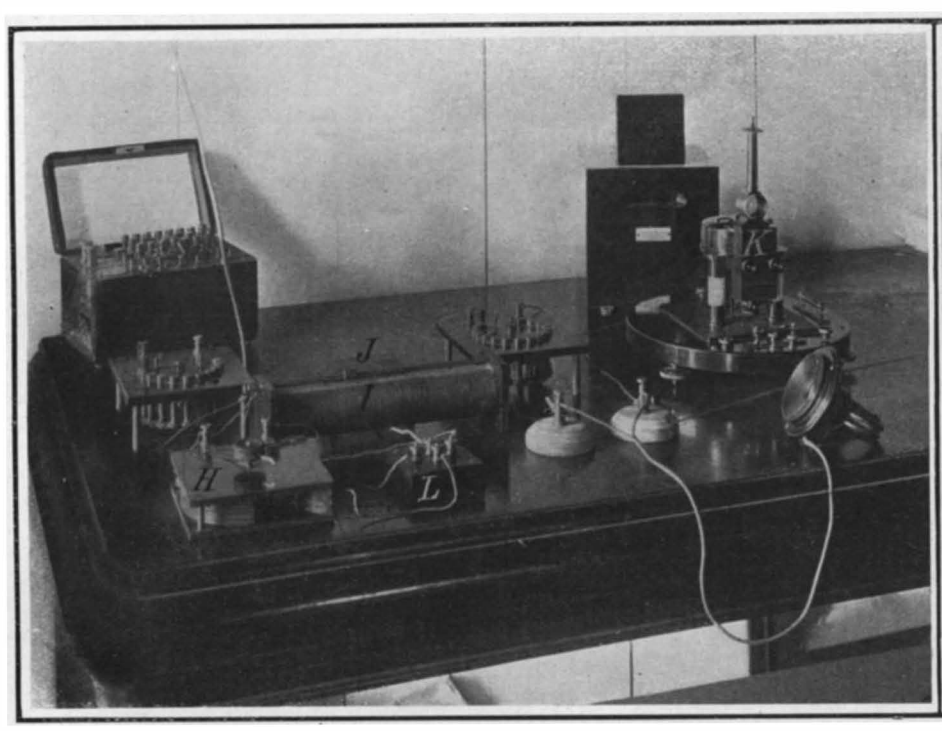
The receptor comprises a thermo-electric detector of Mr. Collins's invention, the fuller details of which it is inadvisable to give out at the present time. It may be said, however, that the principles upon which it is based are entirely different from the numerous other detectors that have made their appearance since the original form of the Branly coherer. Roughly, the detector in question consists of two exceedingly fine wires of different metals crossed at right angles and forming a couple, somewhat on the order of a Boys radio-micrometer, the conduction losses, however, exceeding the radiation losses. Under the junction of these wires is placed a resistance wire, which is heated by the currents surging in the aerial wire system. The detector is sensitive to oscillations of 1/5000 of an erg, and is especially well adapted to the reception of articulate speech. A variable electrolytic resistance is used to modify the current, while the tuning inductance and condensers are very much the same as in other wireless systems.

The highest degree of tuning is obtained by means of a thermo-galvanometer. This instrument comprises a single loop of silver wire suspended between the poles of a permanent magnet. The lower ends of the loop are connected with a bismuth-antimony thermo-couple, which is heated by a fine filament of high specific resistance, through which filament the oscillating current passes, very much as in the detector just described. One end of the heater is connected with the frame of the instrument, in order to avoid electrostatic stress. The heat generated by the passage of the oscillations through the resistance falls on the thermo-junction, and the resulting electromotive force applied to the ends of the silver loop causes it to turn in the magnet field.

In the Newark-New York tests the aerial wire at the sending station had a length of 250 feet, and was formed of four radiating phosphor-bronze wires, making a total of 1,000 feet of wire. At the Singer Build-

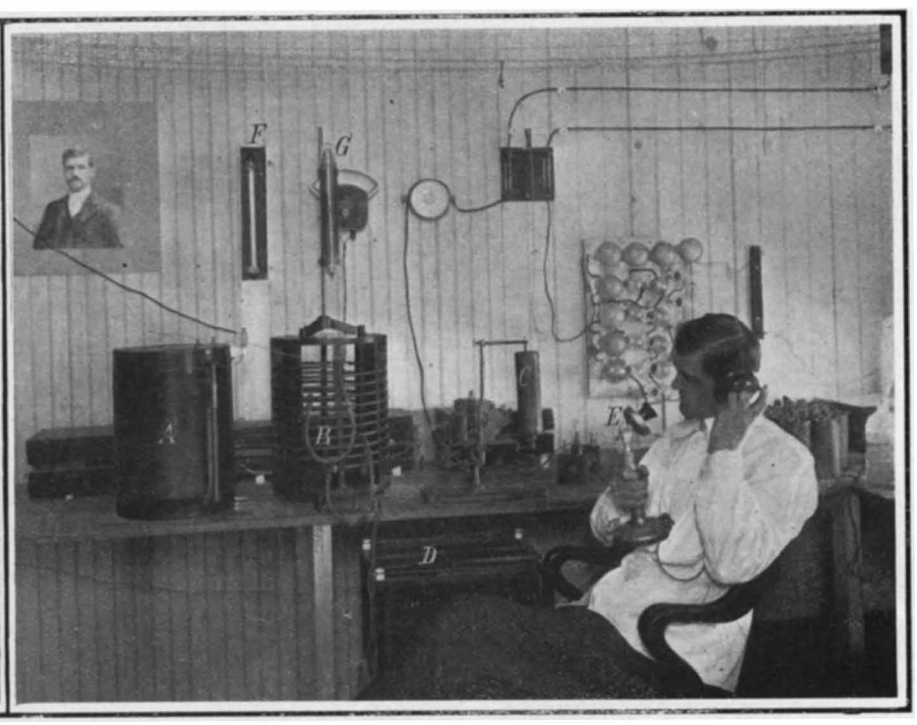


The Elements of the Collins Wireless Telephone System and Their Electrical Relation to One Another.



H. Adjustable Condenser. I. Tuning Coil. J. Battery.
L. Thermo-Electric Detector.

Long-Distance Telephone Receiver With Thermo-Galvanometer for Fine Adjustment.



A. Auto-Transformer. B. Tuning Inductance Coil. C. Arc. D. Condenser.
E. Transmitter. F and G. Resonance Tubes.

Mr. A. Frederick Collins in His Laboratory, Showing Part of His Wireless Telephone Apparatus.

ing the receiving station was located on the twenty-fifth floor, and from the receptor an aluminium wire passed through a window and followed the perpendicular wall to the forty-first story, where it passed through a porcelain bushing, which was suspended at the end of an arm projecting five feet from the cornice of the building. The upper end of the antenna was likewise swung away from the top of the flagstaff, 612 feet above the street level, by means of a highly insulated arm, and the wire was thus kept free from the building.

The receptor was grounded to the water pipe. In the Newark-Congers experiments the aerial consisted of 1,000 feet of aluminium wire held in the air by three kites which were connected in tandem. The same aerial was elevated from the top of the Land Title Building in Philadelphia. Hence in every case there was practically a clear visual line between the sending and the receiving instruments.

PUBLIC SERVICE CAR FENDER AND WHEEL GUARD TESTS.

The Public Service Commission for the first district of the State of New York will hold a car-fender and wheel-guard test on October 20, 1908, at Wilmerding, Pittsburg, Pa. Generally, the tests will consist in picking up or removing from the track three sizes and weights of dummies placed in various positions in front of the car, approaching them at two different speeds. The fenders will be attached to both double and single-truck cars. To conform with the street conditions within New York city, two different kinds of pavement will be imitated on the track roadbed. The three dummies will represent, respectively, a man, a youth, and a child. The first will be about 5 feet 9 inches in height, and weigh 170 pounds; the second about 5 feet 3 inches in height, and weigh 120 pounds; and the third about 4 feet 6 inches in height, and weigh 50 pounds. The dummies will be placed on each type of pavement, not more than 30 feet from the end of such pavement nearest the approaching car. The two speeds at which the test will be made will be six and fifteen miles per hour. The speed at which the car moves will be determined by a speedometer.

The portion of the track prepared for the test will be about 200 feet long, consisting of 100 feet to represent asphalt or macadam surface; and 100 feet of cobble pavement.

The positions in which the dummies will be placed for the test are as follows:

Test No. 1. Dummy placed in an upright position on the track, with its back toward the car.

Test No. 2. Dummy placed in an upright position on the track, facing the car.

Test No. 3. Dummy placed in an upright position on the track, with its side toward the car.

Test No. 4. Dummy lying on the track, with its side toward the car (transversely).

Test No. 5. Dummy lying on its side, with arms extended toward the car.

Test No. 6. Dummy lying somewhat diagonally on the track, with its feet toward the car.

Test No. 7. Dummy lying on its back with its head toward the car.

Test No. 8. Dummy lying on its back with its feet toward the car.

Test No. 9. Dummy lying along the rail, with its head and one arm extended toward the car.

Test No. 10. After the fender or wheel-guard has passed satisfactorily all the tests made for the purpose of determining its life-saving qualities, it will then be subjected to a test to determine its ability to pass over obstacles or obstructions in the roadbed, by running it against boards or blocks spiked down in position.

Each projecting fender will be submitted to Tests No. 1, 2, 3, 5, 7, and 8, with all three dummies, over each type of roadbed and at both speeds, provided the tests are not discontinued as hereinafter prescribed.

Each underneath fender or wheel-guard will be submitted to Tests No. 4, 5, 6, 7, 8 and 9, with all three dummies, over each type of roadbed, and at both speeds, provided also the tests are not discontinued as hereinafter prescribed. The following rules will govern the tests:

1. The entire conduct of the test will be under the direction of a sub-committee of the Public Service Commission for the First District, and only such directions as may be issued by the sub-committee will be recognized.

2. The testing ground will be roped off, and all disinterested parties will be excluded therefrom.

3. Each fender or wheel-guard submitted for test may be represented by not more than two accredited representatives, who must be named before the tests are begun.

4. The order in which devices will be tested will be determined by the sub-committee. Its decisions will be announced as far in advance as possible. A failure on the part of a competitor to be ready in his proper order may result in his being dropped from the competition.

5. A sufficient number of competitors will be notified to occupy the first three days of the test, directing such competitors to be on hand on the morning of the first day the tests begin. Other competitors will be notified by telegram a day in advance of the date upon which they will be called.

6. Fenders must be shipped by the manufacturers or inventors to themselves, care of "Westinghouse Machine Company, Pittsburg, Pa.," with the boxes or crates clearly marked "For fender tests." The commission will not be responsible for the receipt or for the care of any device.

7. For convenience, the tests on both fenders and wheel-guards will be divided into series. A complete set of four tests at one speed on each of the two types of pavement, with one size dummy (12 tests in all), will constitute a series.

8. If fifty per cent of the tests in any series on any fender or wheel-guard are not of Grade "A" as hereinafter defined, the tests on such fender or wheel-guard will immediately be discontinued.

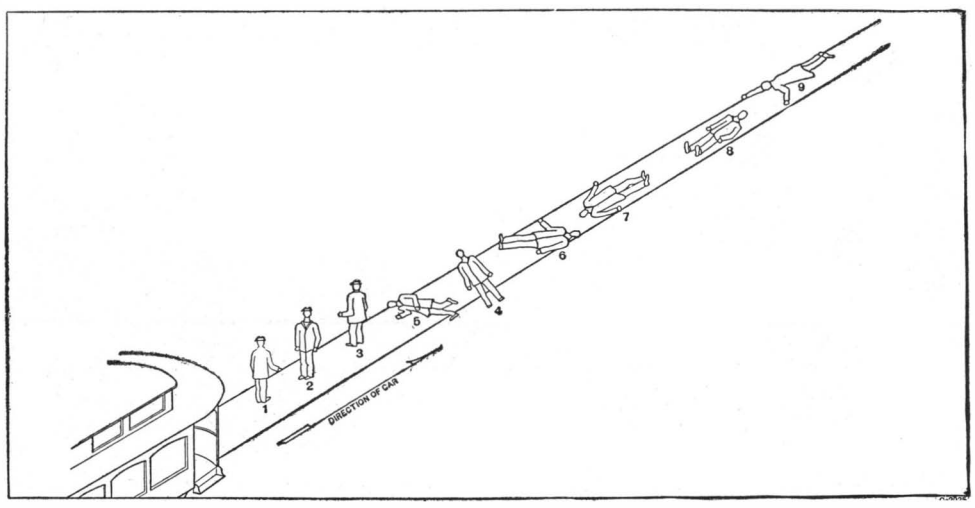
9. The tests will be conducted in the following order:

First Series. 50-pound dummy at 15 miles per hour.

Second Series. 50-pound dummy at 6 miles per hour.

Third Series. 120-pound dummy at 15 miles per hour.

Fourth Series. 120-pound dummy at 6 miles per hour.



POSITIONS OF DUMMIES IN PUBLIC SERVICE CAR FENDER AND WHEEL GUARD TESTS.

Fifth Series. 170-pound dummy at 15 miles per hour.

Sixth Series. 170-pound dummy at 6 miles per hour.

The first series of tests will be made with the devices attached to a double-truck car. A separate series will be conducted with a single-truck car, provided the former set is passed satisfactorily.

10. Only the predetermined number of tests will be permitted, except as provided in these rules. If a device does not pass satisfactorily a sufficient number of tests in any series, a protest may be filed and considered as provided in Rule 9.

11. If the ruling of the sub-committee is disputed at any point in a test, notice of a formal protest shall be given immediately; a formal protest shall be filed on the date of the test, setting forth all particulars, and a hearing shall be held and final ruling rendered in time to permit other tests to be made, if allowed by the sub-committee.

12. In an underneath fender or wheel-guard test, if the dummy is struck by the car and knocked entirely from the roadbed (out of reach of the fender or wheel-guard), this will not be considered as a test, and the trial will be immediately repeated. The same ruling will apply in the case of a fender, if a similar occurrence takes place.

13. When the car comes to a standstill, the results of the test will be graded and recorded as follows:

A complete pick-up or removal from the track by either the fender or wheel-guard, a test of Grade "A," counting 4 points.

If any part of dummy remains under the fender or wheel-guard, but is partially picked up or removed from the track, a test of Grade "B," counting 3 points.

If the dummy is for the most part under the fender or wheel-guard, but still is partially picked up or removed from the track, a test of Grade "C," counting 2 points.

If the dummy is entirely under the fender or wheel-guard, but dragged sufficiently to prevent its going under the car or wheels, a test of Grade "D," counting 1 point.

If the dummy passes under the car or wheels, the test is a complete failure, Grade "E," counting 0.

A Railway to Mecca.

On Tuesday, September 1, was celebrated with great rejoicing the completion as far as Medina of the Hedjaz Railway, which, according to the original plans, is to be continued to Mecca, the starting point being Beirut, on the coast of Palestine. The most remarkable feature of the railway is the manner in which the money was obtained for its construction. It is neither a government nor a commercial undertaking, but has been designed solely to meet the convenience of the thousands of pilgrims who yearly undertake the journey to Mecca to pay their devotions at the shrine of the Prophet Mahomet, and the cost has been defrayed by public subscription—the first time, it is believed, that a railway has been built in this manner. A certain proportion of the money raised was, indeed, compulsorily extracted from the donors, for every official in the employment of the Turkish government and every officer and man in the naval and military forces was levied to the extent of ten per cent on one month's salary. The Sultan himself gave $250,000 in one donation, and has made several smaller contributions in addition. All over the world the Moslem press has published appeals for funds, and these have been answered in the most whole-hearted way, the gifts including, besides money, jewels, silks, ivory, cloths, and merchandise of all descriptions. The only source that appears to have remained untapped is the bazaar and lottery. Altogether some fifteen million dollars have been raised, of which voluntary subscriptions account for more than a half, another million dollars coming from the salary tax.

The work of constructing the railway was commenced in 1904, the line being already laid between Beirut and Damascus. By the end of 1906 the way was completed to a length of 452 miles, to a point 18¾ miles beyond Tebouk. During 1907 another 217 miles were laid, so that by the end of that year trains were running to Bir-Jehid, 669 miles from Damascus, while the same period saw also the completion of the greater portion of the earthworks between Bir-Jehid and Medina, a stretch of 156 miles.

Most of the work of construction is being done by soldiers, of whom about six thousand have been employed in making earthworks and cuttings, and in leveling, laying down and transporting rails, etc. The technical part of the work has been in the hands chiefly of Italians. On reaching Medain-Salih, however, a rearrangement was found to be necessary, for this spot, 612½ miles from Damascus, is considered the boundary of the Holy Land of Hedjaz, into which none but the followers of the true Prophet were allowed to pass. From here to Medina, therefore, a distance of 212½ miles, the work has been entirely in the hands of Moslems, who will also be responsible, unaided, for the remaining 240 miles to Mecca. A branch line 100 miles long has been built from Dareiya, just below Damascus, to Haifa, by Mount Carmel, so that the total length of the line is 1,009 miles, of which 769 miles have been completed. The aggregate expenditure so far is thirteen and three quarter millions of dollars, which works out to $17,800 per mile and leaves a balance in hand of a million and a quarter dollars. It is anticipated that the line will be completed to Mecca within two years. Throughout its whole length it will run parallel with the Derb-el-Haj, the pilgrims' route to Mecca.

A New Life-Saving Appliance.

Capt. G. K. Gandy, R.N.R., is responsible for a useful adjunct to the accepted life-saving appliances required by the English Board of Trade. He has utilized the ordinary canvas cover of a ship's boat so as to form a buoyant raft by the introduction of cork and bamboo cane. This additional element of buoyancy occupies no more room and adds very little weight to the customary equipment of a ship's boat, and possesses the material advantage of being in the most natural and convenient place on a vessel for use when occasion arises. To lower a boat its cover must be removed for the operation, and in the case of the buoyant cover it can be either laid aside or thrown overboard, and, being attached by a line, is there afloat ready for any emergency. The idea has evidently been well considered. The Admiralty have recognized its advantages, the makers having just completed an extensive order for the dockyards.

Correspondence.

Prevention of Street Noises.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to your comment on the rail joint, the writer would say that this fault has apparently been corrected here, by welding a heavy cast-iron chair around the joint. This furnishes a practically jointless rail, and under proper maintaining conditions it lasts indefinitely. The Philadelphia Rapid Transit Company has special road gangs which keep these welded joints in shape by smoothing occasionally with an emery stone weighted with a heavy block of cast iron, and the rail joint is practically noiseless.

A. HARRIS INSINGER.

Philadelphia, September 4, 1908.

Rank of the French Navy.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 8 I read with interest "The German Navy of To-Day," being a continuance of articles on the leading navies of the world. I was under the impression until recently that France was considered a naval power of the first class, holding second place to England; but judging from your articles of 1907-1908 on the American, English, and German navies, it would appear that France is not now so considered, that is as a naval power.

Could I learn through you why and what position she now holds, and if you are to include France in your series? GUSTAVE E. VILLARET.

New York, N. Y.

[The French navy, which is the subject of the present article of the series, holds the fourth position. She is certainly a first-class naval power; but the greater activity of the United States and Germany has placed them in second and third rank.—ED.]

Electrocuting Mosquito Larvæ.

To the Editor of the SCIENTIFIC AMERICAN:

It may please some of the readers of the SCIENTIFIC AMERICAN (especially those interested in the mosquito question) to know that by a simple experiment I have found it possible to kill mosquitoes with electricity. The test is easy and simple. All that is needed is a small glass or transparent vessel filled with water which contains young mosquitoes, commonly called wigglers. This can be obtained from any rain barrel or pool of standing water. Next, 110 volts of alternating current and at least ten 16-candle-power lamps wired in multiple. The lamps would allow at least five amperes to flow, but as the resistance offered by the water is so great not nearly as much power will be used. Place the bank of ten lamps in series with the glass of water containing the mosquitoes, by fastening two small pieces of copper to the ends of wire, which are to be inserted in the water, then turn on the lamps one at a time and the experiment is ended.

I have noted that the mosquitoes at the bottom of the glass were killed as quickly as those nearer the electrodes, which were only a half inch below the surface of the water. The water, offering a much higher resistance than the mosquito's body, allows enough current to pass through the mosquito to kill it.

This experiment may not work out so well with salt water, as salt water offers a lower resistance, but I think the experiment is worth trying.

GEORGE H. STUART.

Elizabeth, N. J., August 29, 1908.

IV.—THE FRENCH NAVY OF TO-DAY.

The present article is the fourth of our series, describing the present condition of the leading navies of the world. The first, published December 7, 1907, dealt with the American navy; the second, on the British navy, appeared on March 7, 1908, and this was followed on August 8 by a description of the German navy. The French navy, to which the present article is devoted, ranks fourth in power, although some authorities are inclined to assign this position to Japan.

Throughout the nineteenth century and the early years of the twentieth, the French navy was recognized as the leading naval power next to Great Britain. It is only since the Russo-Japanese war, and because of the great activity displayed by the other leading powers, that France has had to yield the premier position, first to the United States and then to Germany. The lessons of that war, as incorporated in the "Dreadnought" and the "Indomitable," seem not to have made the instant impression upon France that they did upon her competitors. She was slow to incorporate in her designs those features of size, gun power, and speed, which have made the possession of modern, high-speed, all-big-gun battleships the determining factor in the ranking of the naval powers; and although she has now under construction six "Dreadnoughts" of an excellent design, their construction is proceeding so slowly as compared with the feverish haste displayed by her competitors, that she has fallen from second to fourth position, and in view of the great activity displayed by Japan, may possibly have to rank as fifth naval power within the next two or three years.

The genius of the French engineer and architect has never shown itself to better advantage than in the design of naval warships. The French were the first to incorporate certain important features in their ships, which were destined to exercise a revolutionary effect upon the navies of the world. Unfortunately, this touch of genius has been clouded by a certain extravagance or whimsicality of design, which has made their naval architects tend to run to extremes, and push an idea which was excellent in itself to fantastic and impractical lengths. Also, the French navy, more than any other, has been hampered by political influences. Legislative interference with the naval designer, similar to that which is responsible for those two ships of doubtful modern value, the 13,000-ton, 17-knot "Idaho" and "Mississippi," in the closing years of the last century produced in the French navy a number of ships of such bewildering variety that they cannot readily be assembled in those groups or classes which are necessary to the effectual tactics of actual warfare. Of late years, the government has been disposed to intrust the question of design entirely to the naval authorities, with the result that the later ships, which have been built in groups of four or six, are comparable with the best contemporary warships of other nations, and in some respects are superior. In this connection, as showing the valuable contribution made by the French in the development of the modern warship, we may refer to the fact that they were the first to introduce side armor, and the high-explosive shell. Moreover, they were the first to recognize the value of high velocity in artillery, anticipating the other nations by many years in the introduction of guns of great length and high ballistic quality in proportion to their weight. Also, they have long recognized the advantage of high command for the guns; and although this quality, like many others, was pushed to extreme length, many of their ships being so topheavy and unstable as to require subsequent modification, the French deserve credit for emphasizing a feature which is now being widely incorporated in the later ships of contemporaries.

SUMMARY.—The French navy includes twenty-two battleships of over 10,000 tons displacement, the oldest of which was launched in 1891. Six of these, of a modified "Dreadnought" type, are at present under construction. The total displacement of the twenty-two ships reaches 310,116 tons. Of battleships too old or too small to be used for anything but coast defense, the French have the "Hoche," launched in 1886, of 10,581 tons, and the "Henri IV," launched in 1899, of 8,807 tons. In this class also may be reckoned a dozen smaller, coast-defense ships and older battleships of from 6,000 to 12,000 tons displacement, whose limitations of size, speed, and coal endurance would necessitate their operating within comparatively easy reach of a friendly port. France possesses eighteen ships of the armored-cruiser type, whose total displacement is 191,761 tons. They vary in displacement from 7,578 tons to 13,780 tons, and the speed ranges from 21 to 23 knots. Of second-class cruisers, she has nine ships totaling 55,797 tons, of from 4,681 tons and 18 knots to 7,898 tons and 23 knots. These are chiefly of the protected-cruiser type, a few being older armored cruisers, lightly protected with side armor. There are twenty-one third-class cruisers of from about 2,000 to about 4,500 tons displacement, whose speed ranges from 19 to 20½ knots. The total displacement of these vessels is 66,773 tons. The French torpedo fleet numbers seventy-six destroyers, of from 250 to 436 tons displacement and from 25 to 33 knots speed; forty-two sea-going torpedo boats, of from 120 to 185 tons displacement and from 20½ to 30 knots speed; and 290 torpedo boats, of from 54 to 97½ tons displacement and from 20 to 26 knots speed. Her submarine fleet is a large one, numbering sixty-one boats, of from 106 to 577 tons displacement, and from 8 to 10 knots submerged speed.

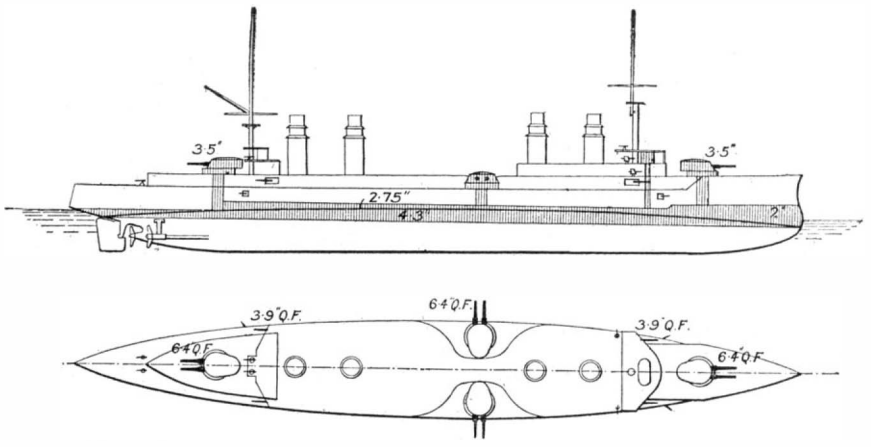
BATTLESHIPS.—By far the most important section of the French navy is the group of six battleships of the "Danton" class (1906-7) due to be completed in 1910-11-12. They are of a modified "Dreadnought" type, carrying four 12-inch 50-caliber guns, and twelve 9.4-inch guns also of 50 calibers length. It is a question whether the gain in the rapidity of fire, due to the use of the lighter 9.4's, is compensated by the loss of energy of the individual projectiles. The English evidently think not; for they built but two ships of the "Danton" type, namely, the "Nelson" and "Agamemnon," and in their late ships, in common with the other naval powers, are using the 12-inch exclusively as the main armament. In the "Danton," the 12-inch guns are carried in turrets protected by 12 inches of armor, and the 9.4's are mounted in pairs in turrets protected by 8.7 inches of armor. They carry a belt 10 inches in thickness amidships and 6 inches at the ends, and this excellent side protection extends to the main deck in thickness varying from 8.7 inches to 6 inches. The speed is low for ships of this class, the expectation being that with 23,000 horse-power and Parsons turbines, a speed of 19.25 knots will be secured. Next in importance is the "Démocratie" class (1903) of four ships. They are of 14,900 tons displacement and 19½ knots trial speed. The 11-inch belt tapers to 9 inches forward and 7 inches aft. Above this is a 10-inch belt tapering to 5½ inches at the ends. The protective deck is 2¾ inches. Four 12-inch guns of 50 calibers length are mounted behind 12 inches of armor in two turrets; and ten 7.6-inch guns are carried, six of them in single-gun turrets above the spar deck; two in casemates forward on the main deck, and two in casemates aft on the gun deck. The ships of this class have the same high freeboard as the "Danton" class, and as in them the armor protection is admirable. Their battery, however, is light in comparison to that of battleships of the same date in foreign navies. The two battleships "Republique" and "Patrie" (1901-2), on which the "Démocratie" class are an improvement, have similar armor protection; but the battery is less powerful, the four 12-inch guns being of an earlier 45-caliber pattern, and the secondary battery consisting of eighteen 6.4-inch 45-caliber guns, this latter being a much less powerful piece than the 7.4-inch. The 6.4's are mounted in six two-gun turrets above the spar deck, and in six casemates, two forward on the main deck abreast of the conning tower, and the other four amidships on the gun deck. These two are 19-knot ships. The "Suffren," laid down in 1899, is an instance of one of those individual ships in the French navy, which belong to no particular class. She is of 12,750 tons displacement and 18 knots speed. In many respects she may be taken as the type ship from which the "Republique" and "Démocratie" classes were developed; for she was the first battleship to mount the 6.4-inch gun in turrets in place of the old and comparatively feeble 5.5-inch mounted in broadside. Particulars of this ship will be found beneath the illustration on the front page of this issue. Next in fighting value to the "Suffren" are the three battleships of the "Charlemagne" class: the "Charlemagne," "St. Louis," and "Gaulois," the particulars of which are given beneath the accompanying engraving of the last-named ship. In them, for the first time, the French adopted the plan, inaugurated by Mr. White in the British ships of the "Royal Sovereign" class, of mounting the main battery in two positions, one forward and one aft of the superstructure, with a numerous battery of rapid-fire guns in a central broadside battery amidships. They are heavily protected by a 16-inch belt which tapers considerably less than similar belts in the ships of foreign navies, the least thickness being 10 inches at the ends. They are provided with two protective decks, one above and one below the belt, an excellent feature which originated with the French designers. The main armament consists of four 12-inch guns of 40 calibers length. This piece, because of the light weight of the projectile, 644 pounds, and in spite of its high velocity of 2,700 feet a second, is not very effective at modern battle ranges, its penetration of Krupp armor at 8,000 yards being only 5½ inches. In the later 12-inch models, however, both the weight of shell and the velocity have been greatly increased. In the 50-caliber model of 1902 as mounted in the "Démocratie" class, the shell weighs 731 pounds, the velocity is 3,000 feet a second, and the penetration at 8,000 yards is 9 inches. Not satisfied with this, the French have brought out a 50-caliber 12-inch piece, known as the 1906 model, which fires a 1,000-pound shell at over 3,000 feet velocity, and penetrates 12 inches of Krupp steel at 8,000 yards. This is the most powerful 12-inch gun in existence, and it will form the main armament of ships of the "Danton" class. Between 1893 and 1896 the French launched four battleships, the "Charles Martel," "Carnot," "Massena," and "Bouvet," varying in displacement from 11,882 tons to 12,205 tons, which in the arrangement of the main battery may properly be considered to constitute a single class, but which vary in minor details sufficiently to render them not strictly homogeneous.

The description printed below the accompanying engraving of the "Massena," and the general appearance of that ship, will serve to give a fair description of any one of the four. The latest and largest is the "Bouvet," launched in the spring of 1906. She has a 16-inch belt, tapering to 10 and 12 inches aft and forward; a 3½-inch deck above and a 1¾-inch deck below the belt; and her 12-inch turret guns are protected by 14 inches of armor. The distinguishing characteristic of these four ships is that the four guns of the main battery consist of two different calibers. A 12-inch gun is mounted forward on the forecastle deck in a single turret; another 12-inch is mounted aft on the main deck in a single turret; and on either beam, amidships, is a 10.8-inch gun carried in a single turret upon armored sponsons built out beyond

the tumble-home sides of the ship. This tumble-home, by the way, is very marked, and constitutes a strongly distinctive characteristic of the early French battleships. In each of these vessels the secondary battery, which is weak compared to that carried by contemporaneous battleships of other navies, consists of eight 5.5-inch guns, mounted in turrets; two aft on the gun deck, four amidships, forward and aft of each amidships 10.8-inch gun, and two forward on the main deck abreast of the forward 12-inch, the latter being mounted on the forecastle deck. One great advantage of this system is that there is but one gun to each turret, an arrangement which is conceded to be the best possible for accuracy of fire and protection from the enemy's shells. The disadvantage is that only three of the guns of the main battery can be trained on either broadside. The "Jauréguiberry," launched in 1893, carries the same battery and has the same system of armor protection, but the 5.5-inch guns are mounted in four two-gun turrets, two forward and two aft on the main deck. On trial the speed of the "Jauréguiberry" and the four succeeding ships was about 18 knots.

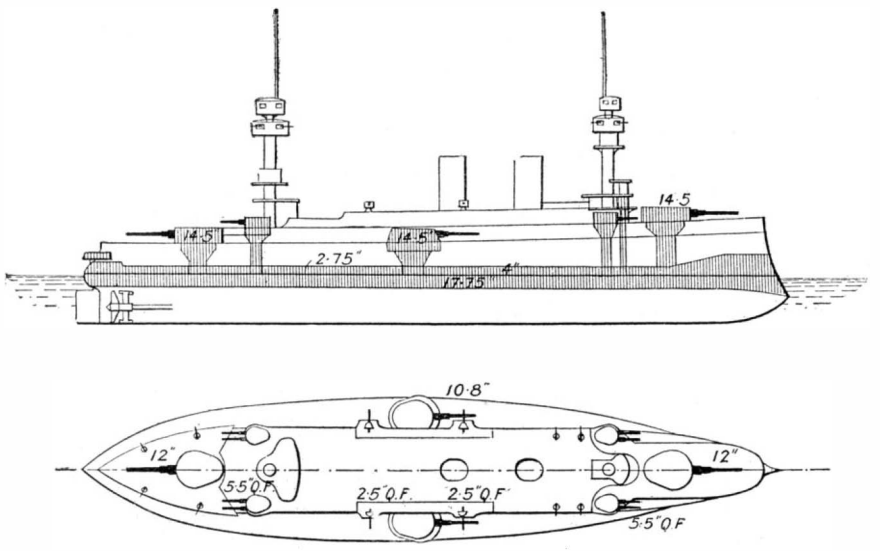
ried in casemates. This vessel was followed by a remarkable craft, the "Jeanne d'Arc," a huge vessel, for those times, of 11,270 tons, with the high speed of 23 knots and the large bunker capacity of 2,100 tons. She also carried liquid fuel, for whose introduction into warships the French are again responsible. She mounts two 7.6-inch guns in turrets, and a battery of fourteen 5.5-inch guns, eight of them in casemates on the main deck, and six mounted behind shields on the spar deck. She is protected by a 6-inch belt; by 7¾ inches on the turrets and 5 inches on the casemates. With her great length, high freeboard, and six funnels, she presents a striking and formidable appearance. In the next batch of three ships, the "Dupleix" class, the displacement fell to 7,700 tons, and the speed to 21 knots. The belt was reduced to 4 inches; and the armament consists of eight 6.4-inch guns carried in four turrets—one forward, one aft, and one on each beam amidships. The "Gueydon" class of three ships (1897-9) of 9,517 tons and 21 knots speed, are protected by a 6¾-inch belt, reaching to the gun deck, which reduces to 4 inches at the bow, where it is carried up to the main deck,

secondary battery will consist of twelve 6.4's of an improved 50-caliber pattern, mounted eight of them in eight single turrets on the spar deck; two forward in casemates on the main deck, and two aft in casemates on the gun deck. She has a large coal capacity of 2,300 tons, and carries oil in her double bottom. Similar to the "Ernest Renan," but of 1,000 tons less displacement, is the "Jules Michelet." In the latest armored cruisers, "Edgar Quinet" and "Waldeck Rousseau," now under construction, of 14,000 tons and 23 knots speed, the battery consists entirely of 7.6-inch 45-caliber guns, two forward and two aft in two-gun turrets on the forecastle and main decks; six in single turrets on the spar deck, two in casemates forward on the main deck, two in casemates aft on the gun deck. The protection consists of a 6¾-inch belt; 6 inches on the turrets and casemates. They carry 2,300 tons of coal, and are credited with a radius of 10,000 to 12,000 miles at 10 knots cruising speed. The French armored-cruiser fleet forms an aggregation of splendid fighting material, fast and seaworthy, though one could wish that the offensive power was greater.



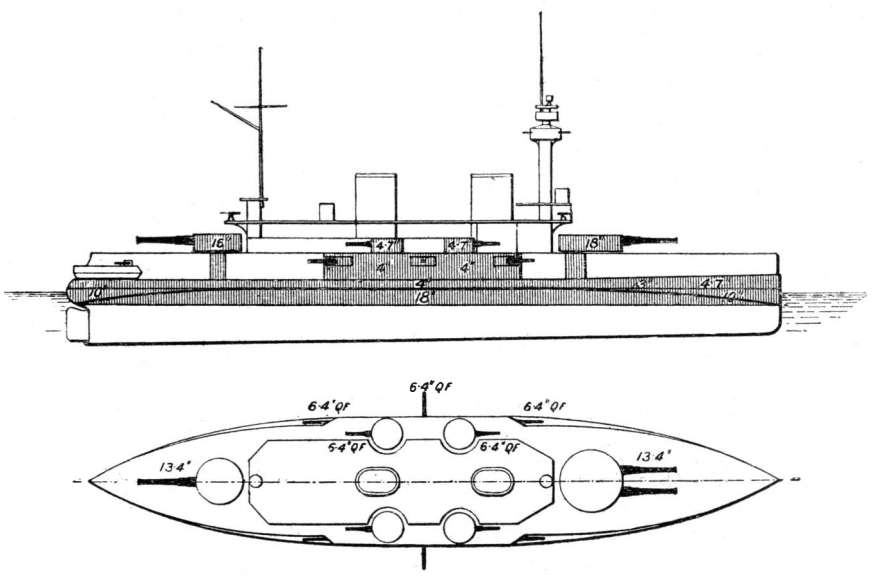
Displacement, 7,700 tons. **Speed,** 21 knots. **Coal,** 1,200 tons, plus oil. **Armor:** Belt, 4 to 3½ inches; deck, 2¾ inches; turrets, 4 inches. **Armament:** Eight 6.4-inch; four 4-inch; ten small guns. **Torpedo tubes,** 2. **Complement,** 550.

Armored Cruiser "Desaix." Class of Three Ships.



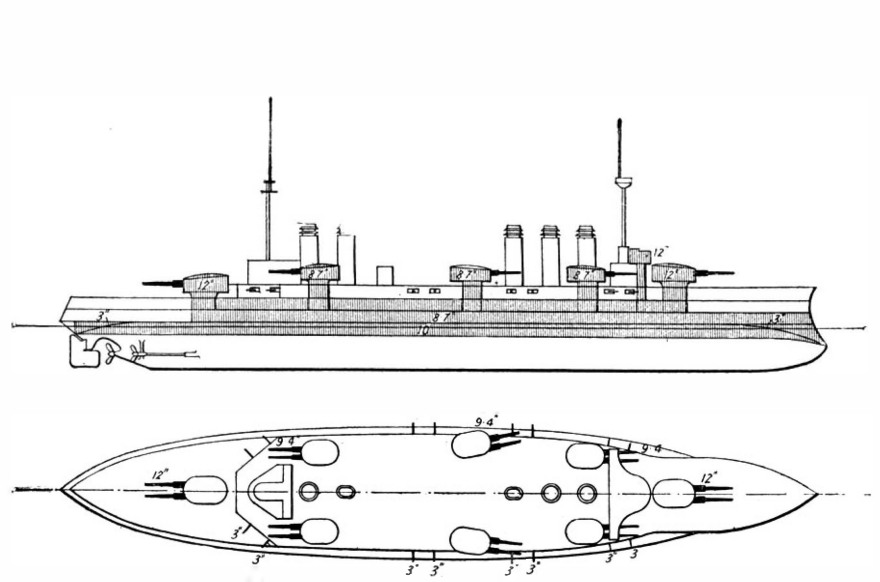
Displacement, 11,900 tons. **Speed,** 18 knots. **Coal,** 1,100 tons. **Armor:** Belt, 17¾ to 9¾ inches; decks, 2¾ and 1⅛ inches; side, 4 inches; main turrets, 14½ inches; secondary turrets, 4 inches. **Armament:** Two 12-inch; two 10.8 inch; eight 5.5-inch; twenty small guns. **Torpedo tubes,** 4. **Complement,** 607.

Battleship "Jaureguiberry."



Displacement, 11,395 tons. **Speed,** 18 knots, **Coal,** 800 tons. **Armor:** Belt, 18 to 12 inches; deck, 3 inches; side, 4½ inches; turrets, 18 inches; secondary turrets, 4¾ inches. **Armament:** Three 42-caliber 13.4-inch; ten 6.4-inch; twenty small guns. **Torpedo tubes,** 6. **Complement,** 696.

Battleship "Brennus."



Displacement, 18,400 tons. **Speed,** 19.25 knots. **Coal,** 2,000 tons. **Armor:** Belt, 10 to 6 inches; two 3-inch decks; side armor, 10 to 6 inches; main turrets, 12 inches; secondary turrets, 8.7 inches. **Armament:** Four 50-caliber 12-inch; twelve 50-caliber 9.4-inch; sixteen 3-inch; ten 3-pounders. **Torpedo tubes,** 2. **Complement,** 753.

Battleship "Danton." "Dreadnought" Class of Six Ships.

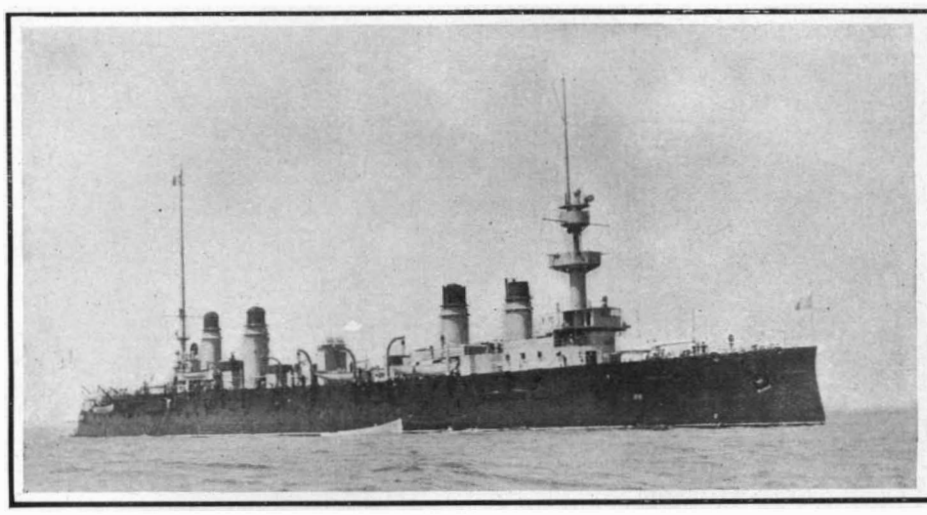
IV.—THE FRENCH NAVY OF TO-DAY.

Armored Cruisers.—We have spoken of the originality of the French designers, and the powerful influence they have exerted upon the general warship design of the navies of the world. The armored cruiser, which originated in France, is a case in point, the first of this type being the "Dupuy de Lôme," launched as far back as 1890. This vessel, of 6,400 tons and 20 knots speed, is clothed entirely from stem to stern and up to the main deck with steel armor whose greatest thickness amidships is 4¾ inches. This extensive armor was the result of the introduction, by the French, of high-explosive shells. The "Dupuy de Lôme" carries two 7.6-inch and six 6.4-inch guns, all in single turrets, protected by 4 inches of armor. Two or three years later, the "Latouche Tréville" and the "Bruix," of 4,750 tons and 18½ knots speed, were launched. They have a 3½-inch belt which extends to the gun deck only, and are armed with two 7.6-inch and six 5.5-inch guns mounted in single turrets. Then followed the "Pothauau," of 5,360 tons and 19 knots speed, protected from the main deck down by a 2⅜-inch belt, associated with a 3⅜-inch deck. She mounts two 7.6-inch and ten 5.5-inch guns, the latter being carthis last being an excellent feature, characteristic of all the later French armored cruisers. Two 7.6-inch guns are mounted in single turrets on the forecastle deck, and eight 6.4-inch guns in casemates on the main deck. They also carry four 4-inch guns on the spar deck behind shields. Further particulars of this class are given below the engraving of the "Montcalm." The "Gloire" class of four ships are enlarged and improved "Gueydons," carrying armor of the same thickness, but of superior Krupp manufacture. Four of the eight 6.4-inch guns are mounted in single turrets amidships on the spar deck. The displacement is 10,000 tons. In the "Léon Gambetta" class of three ships (1901-3) the displacement rose to 12,416 tons, the speed to 22½ knots, and the coal capacity to 2,100 tons, plus oil fuel. The belt is 6¾ inches, thinning to 3 inches at the ends. The four 7.6-inch guns are carried in two two-gun turrets; and of the sixteen 6.4-inch, twelve are in two-gun turrets behind 5½ inches of armor on the spar deck, and four in casemates on the main and gun decks.

The "Ernest Renan" (1903) is of 13,644 tons and 23 knots speed. Her four 7.6-inch guns are mounted similarly to those of the "Léon Gambetta," and her

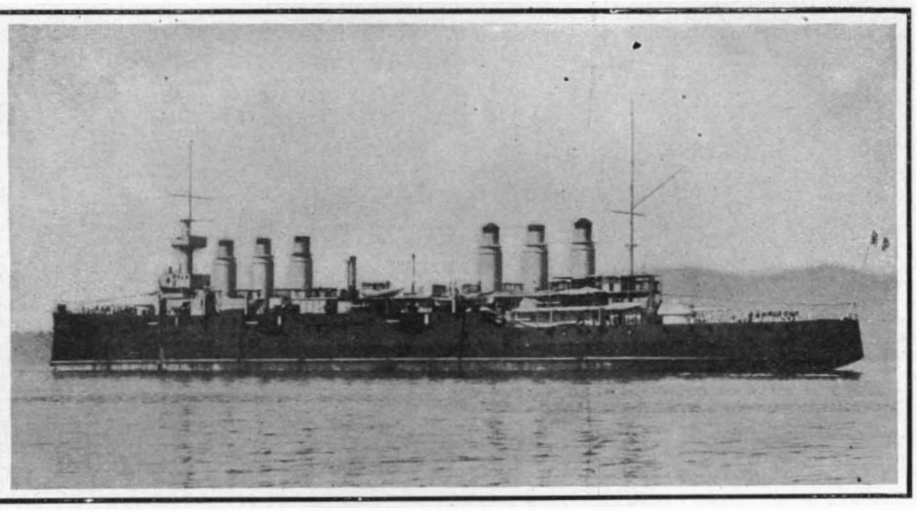
Protected Cruisers.—It is impossible, within the limits of the present article, to enter into any detailed description of the numerous and widely-diversified protected cruisers of the French navy. The most important are the "Chateaurenault," "Guichen," and "D'Entrecasteaux," each of about 8,000 tons displacement. Their respective speeds are 24.5, 23.5, and 19.2 knots, and their respective coal capacities 2,100, 2,000, and 1,000 tons. The first two are armed with two 6.4 and six 5.5-inch guns, and the "D'Entrecasteaux" with two 9.4's and twelve 5.5-inch guns. The smaller protected cruisers are armed generally with 6.4-inch and 5.5-inch guns, and the speeds range from 19 to 20 knots.

The destroyers of the French navy call for no further mention than has already been made in the present article. Of the submarines, we can say that because of the fact that the French, true to their habit of taking the initiative, were the first to seriously undertake the building of submarines, their fleet necessarily presents many and widely divergent types. In their later vessels of over 500 tons displacement, the speed has been raised to 15 knots on the surface and 10 knots submerged.



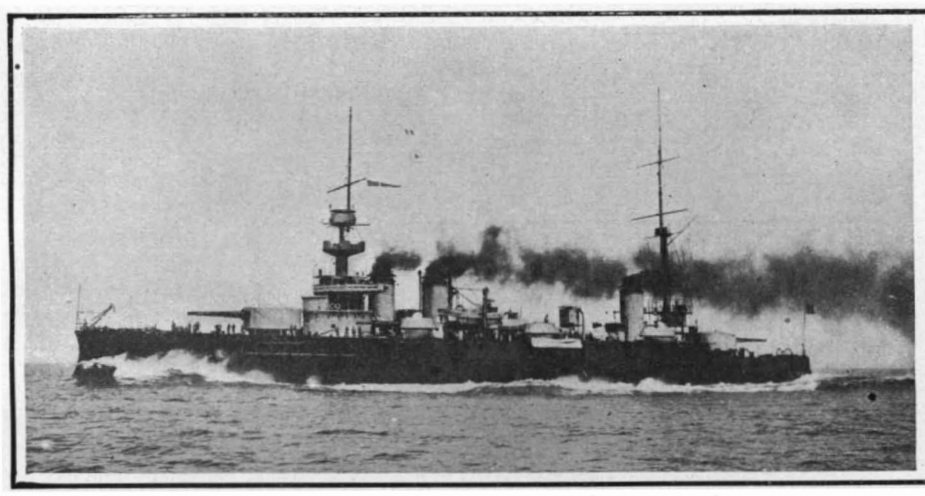
Displacement, 9,517 tons. **Speed,** 21.1 knots. **Coal,** 1,600 tons, plus oil. **Armor:** Belt, 6¾ inches; side, 3¾ inches; deck, 2 inches; turrets, 8 inches; casemates, 4 inches. **Guns:** Two 7.6-inch; eight 6.4-inch; four 4-inch. **Torpedo tubes,** 2. **Complement,** 612.

Armored Cruiser "Montcalm." Three Ships.



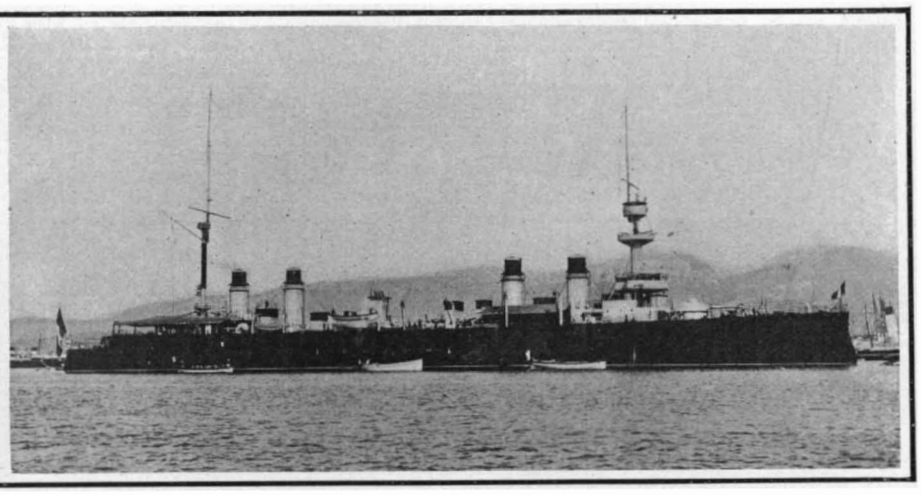
Displacement, 11,270 tons. **Speed,** 23 knots. **Coal,** 2,100 tons, plus oil. **Armor:** Belt, 6 inches; deck, 2¼ inches; turrets, 7¾ inches; casemates, 5 inches. **Guns:** Two 7.6-inch: fourteen 5 5-inch; twenty small guns. **Torpedo tubes,** 2. **Complement,** 626.

Armored Cruiser "Jeanne d'Arc."



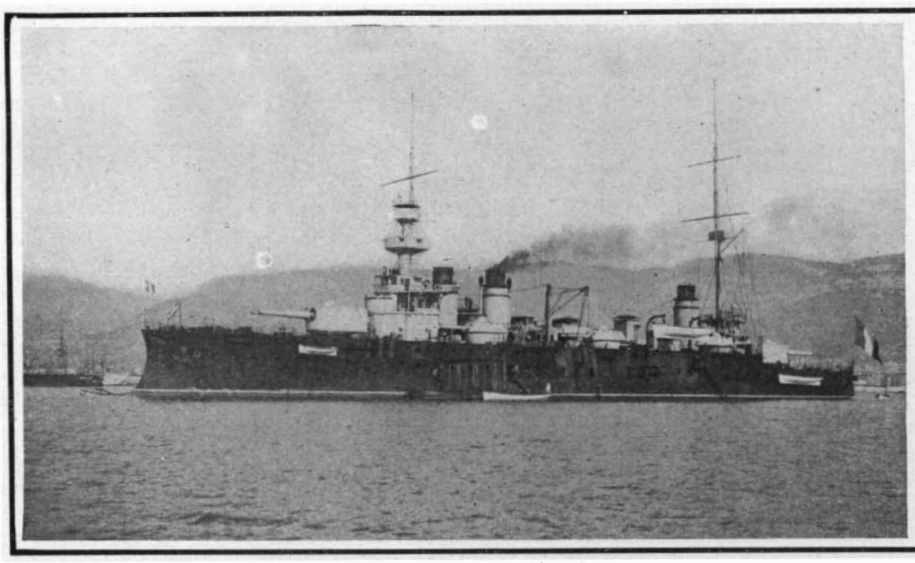
Displacement, 14,900 tons. **Speed,** 19.5 knots. **Coal,** 1,825 tons. **Armor:** Belt, 11 inches; deck, 2¾ inches; main turrets, 12 inches; secondary turrets, 5½ inches; casemates, 5½ inches **Guns:** Four 50-caliber 12-inch; ten 7.6-inch; twenty-three small guns. **Torpedo tubes,** 4 **Complement,** 793.

Battleship "Démocratie." Four Ships.



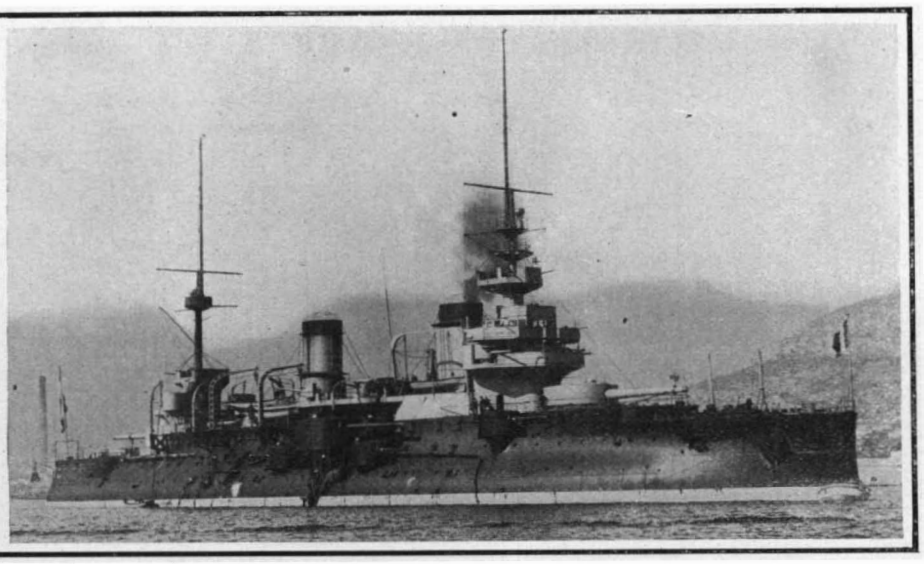
Displacement, 10,000 tons. **Speed,** 21.6 knots. **Coal,** 1,590 tons. **Armor:** Belt, 6¾ inches; deck, 2½ inches; main turrets, 8 inches; secondary turrets, 4¾ inches; casemates, 4¾ inches. **Guns:** Two 7.6-inch; eight 6.4-inch; six 4-inch; twenty small guns. **Torpedo tubes,** 5. **Complement,** 550.

Armored Cruiser "Marseillaise." Four Ships.



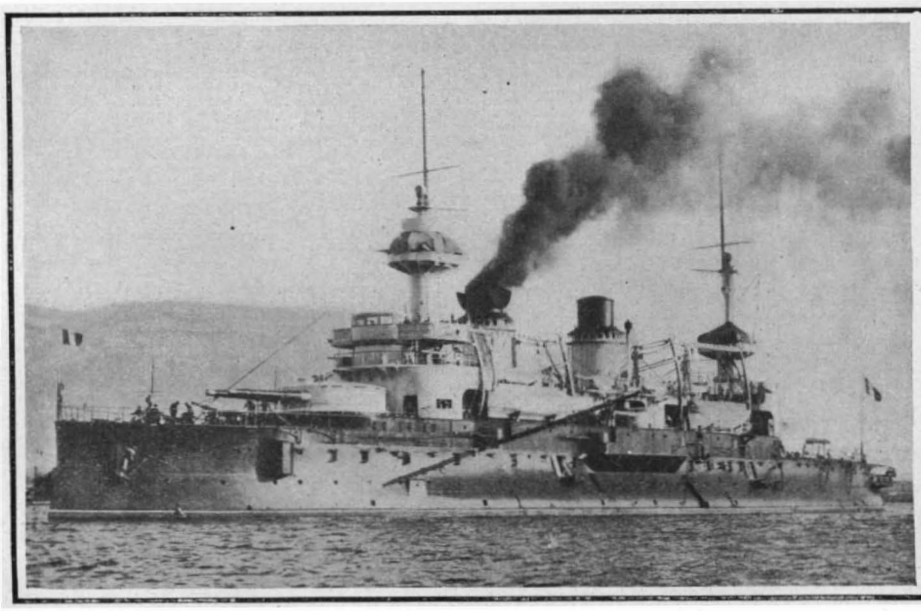
Displacement, 11,685 tons. **Speed,** 19.1 knots. **Coal,** 1,850 tons. **Armor:** Belt, 11 inches; deck, 3 inches; side, 10 to 5 inches; main turrets, 12½ inches; secondary turrets and casemates, 5½ inches. **Guns:** Four 12-inch; eighteen 6.4-inch; twenty-eight smaller guns. **Torpedo tubes,** 5. **Complement,** 793.

Battleship "Republique." Two Ships.



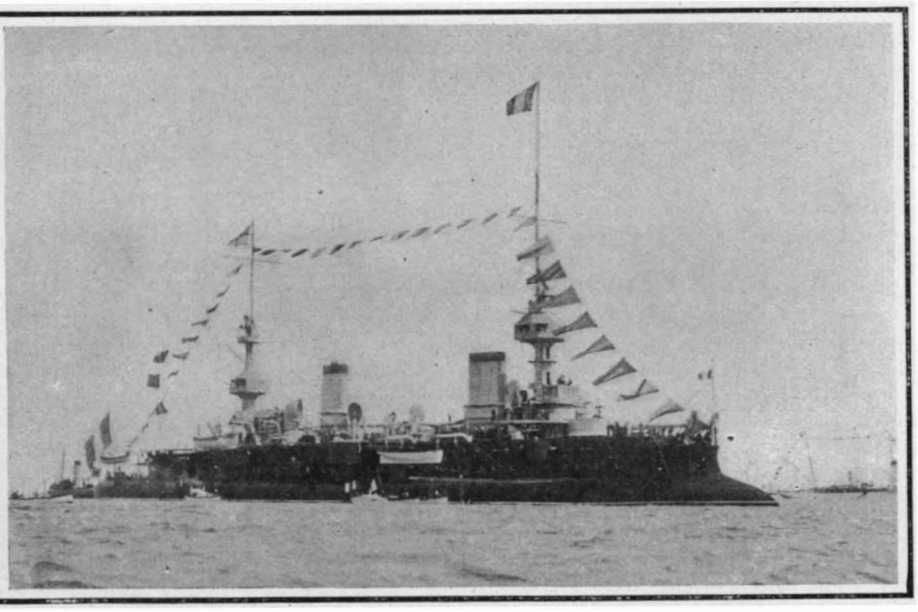
Displacement, 12,205 tons. **Speed,** 17⅛ knots. **Coal,** 800 tons. **Armor:** Belt, 16 inches; decks, 3½ and 1¾ inches; sides, 4 inches; main turrets, 14 inches; secondary turrets, 4 inches; **Guns:** Two 12-inch; two 10.8-inch; eight 5.5-inch; eight 4-inch; thirty small guns. **Torpedo tubes,** 4. **Complement,** 630.

Battleship "Bouvet." Four Ships (Approximate).



Displacement, 11,260 tons. **Speed,** 18.2 knots. **Coal,** 1,100 tons **Oil,** 200 tons. **Armor:** Belt, 16 inches; decks, 2¾ and 1½ inches; sides, 3 inches; main turrets, 9 and 11 inches; secondary battery, 3 inches. **Guns:** Four 12-inch; ten 5 5-inch; eight 4-inch; twenty small guns. **Torpedo tubes,** 4. **Complement,** 631.

Battleship "Gaulois." Three Ships.



Displacement, 11,924 tons. **Speed,** 18 knots. **Coal,** 800 tons, plus oil. **Armor:** Belt, 17¾ inches; decks, 3½ and 1½ inches; turrets, 16 inches; secondary turrets, 4 inches. **Guns:** Two 12-inch; two 10.8-inch; eight 5.5-inch; eight 4-inch; fourteen small guns. **Torpedo tubes,** 4. **Complement,** 617.

Battleship "Massena."

IV.—THE FRENCH NAVY OF TO-DAY.

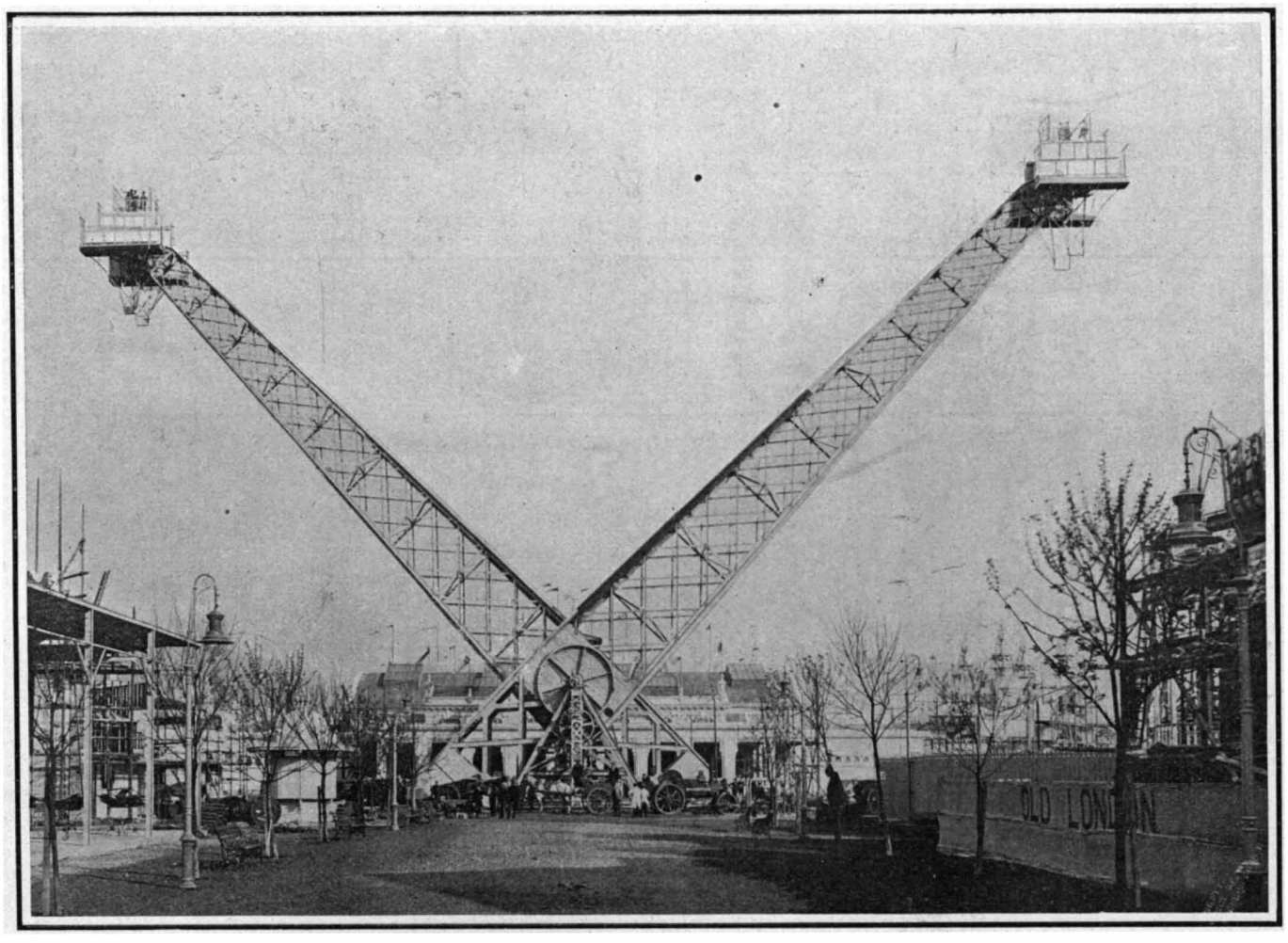
THE "FLIP-FLAP."

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Successive expositions have in turn contributed an individual sensational side-show, and in the Franco-British Exhibition the requirements in this direction are fulfilled with the "Flip-Flap." Since it has been in operation this amusement has proved remarkably successful, and the efforts to comply with the demands of the curious to experience a whisk through the air have severely taxed the resources of the apparatus.

The sensation comprises a slow passage in a semicircle through the air in a car suspended at the extremity of either of two tapering arms, which normally rest in a horizontal plane, the cars being so suspended as to maintain constantly a vertical position. The general idea of the apparatus, which has been designed by Mr. Claude W. Hill, A. M. Inst. C. E., of Westminster, London, may be gathered from the accompanying illustration, which shows the arms after completing about a quarter of their travel.

The two arms or masts are each 150 feet in length, built up of latticed steel and tapering toward their outer extremities. These masts swing upon a pivot or shaft placed near the lower end, as shown in the illustration, and carried on steel trestles placed 20 feet above the ground. The over-all length of each arm is 186 feet, and it is pivoted about 36 feet from the lower end, which forms the tail. This latter section carries a balance weight composed of concrete rammed into an iron box, and by its provision not only is the minimum of power required in moving the arms, but it also acts as a safety device, overcoming any liability for an arm to drop suddenly. In the event of an accident or breakdown to the driving mechanism, the arms simply revert to a vertical position, whence they can be easily hauled down by ropes. The cars swing on a center pivot, and the constant vertical position is assured by counterweights carried in the body of the car below the pivot.



THE "FLIP-FLAP" AT THE FRANCO-BRITISH EXPOSITION.

The arms, which oscillate in opposite directions, are electrically driven by a shunt-wound motor developing 100 brake horsepower at a speed of 500 revolutions per minute. This motor is placed on the driving platform, which is arranged between the two arms, while the operator's cabin, in which is placed the main switchboard controller and signaling arrangements, is situated also between the arms above the axle, so as to secure a clear view of the working of the masts.

The power from the motor is transmitted first through worm and worm gearing to central bevel wheels by means of a vertical shaft, these bevel wheels being used in order to balance the wind pressure on the arms. Should this be equal, no load attributable to wind pressure is imposed upon the motor; while on the other hand, should the wind pressure be unequal, then the difference only is taken by the motor. From these bevel wheels the power is taken through differential gearing to four driving chains, which drive the set of gearing on either side of each arm.

By means of the differential gearing the wind-pressure stresses on the gearing on each side of the arms is equalized, thereby obviating any twisting strains on the arm itself; also it serves to distribute equally the driving power of the motor.

On either side, at the point where the cars rest when the arms are horizontal, is an anchorage and landing station. The cars carry locking bolts, which firmly secure the ends of the arms during the time passengers are embarking or disembarking, while a signal system is also adopted, coinciding with those in the operator's cabin. Emergency switches are also provided which enable the arms to be stopped at any point in their travel in case of accident without communicating with the engineer's cabin, while moreover limit switches are available for applying brakes should the engineer inadvertently allow the arms to travel beyond the landing stages, in which event also the arms come into contact with hydraulic buffer stops, which bring them gently to rest without any violent vibration or shock.

The arms are mounted upon wheels 16 feet in diameter, there being two to each mast, to which each is secured by 146 bolts, so that absolute rigidity is secured. The four driving chains have a maximum pull on each of 1,520 pounds. The brake wheels of the electro-magnetic brake gear are 34 inches in diameter by 4½ inches wide between flanges, with shoes of poplar wood. The solenoid plunger magnets give a pull of 60 pounds with 125 volts on the terminals of the coil, and with the plunger in the outer position. There are four of these solenoids in series in a 500-volt circuit, and the dashpots, though permitting the weights to be lifted quickly, only allow them to go down slowly.

The system of working the apparatus is very simple, passengers embarking simultaneously at either end, each car having accommodation for 48 persons, the internal arrangements of the car being in tiers, to allow everyone to secure an uninterrupted view from his point of vantage. When one car is full the attendant withdraws his locking or anchoring bolt, which automatically indicates by the signal system that he is ready to start to the attendant of the opposite car, and also warns the engineer in his cabin. A similar cycle of operations follows upon the second car being filled with passengers, and the coincidence of the signals informs the engineer that the driving mechanism can be set in motion. Sighting facilities are provided, to enable the latter to bring the arms to rest at their precise positions upon the conclusion of the journey.

During the trip, should an attendant accidentally or purposely close one of the bolts by which the arms are anchored to the landing stage, the mechanism is instantly stopped. But the withdrawal of the bolt will not re-start the machinery. This can only be effected by the engineer, who has to return his controller handle to the "off" position and make a fresh start. No matter by what means the progress of the arms is arrested, once the journey has commenced this return has to be made. It will thus be realized that every precaution is observed to prevent an accident, and similar measures are observed in regard to the propelling mechanism itself.

The journey made by the car is a complete semicircle through the air which is about 470 feet in length. The traveling speed is about 160 feet per minute, so that the trip occupies about three minutes. When the journey is half completed the cars stand side by side, and the passengers being at an altitude of about 170 feet off the ground, have a magnificent view over the exhibition. Between the trestles supporting the axle a pit is provided in which the tails of the arm swing, since in the perpendicular position the ends of the arms are about 16 feet below ground level. Travel is perfectly smooth and without the slightest vibration, the passengers having no sensation of movement. Indeed, the feeling is very similar to that experienced in a balloon ascent. The total cost of the apparatus was approximately $150,000.

New Telephotographic Process.

While the processes of Korn, Carbonelli, "Grühn" (Grzanna), Cerebotoni, and others which have been made known up to date, transmit to a distance pictures of photographs already made, Sivelli has produced an apparatus for photographing at a distance any object at the transmitting station.

The transmitter consists of an ordinary photographic camera, the sensitive plate of which is replaced by one consisting of small isolated selenium squares, and in electric connection with one pole of the source of current. Leading from the other pole is an insulated wire, which dips in a small vessel of mercury on a horizontal plane. There are as many such mercury cups as there are selenium squares. They lie in the circumference of a circle, about the center of which a hand rotates, driven by clockwork, and provided on its free end with wire, touching all the mercury vessels one after the other. This hand is in electric connection with the wire which leads to the receiving apparatus, and which is fully insulated from the other portions of the apparatus.

The device operates as follows: After the camera lens is directed on the object to be photographed at a distance, an interrupter at the sending station is set in action. The rotating hand is then set in motion, so that it touches in rapid succession the mercury cups connected with the various selenium squares. In its first position this hand lies near the cup which corresponds with the first selenium square in the upper horizontal row. The electric current passes through that selenium square which is in connection with the hand, and is strengthened or weakened according to the intensity of the light on the square. These variations of current strength, corresponding with the illumination of the selenium square, are transmitted in regular order to the receiving station, where they are translated into light rays.

The receiving apparatus may have any one of several forms. That preferred by Sivelli is based on the following principle:

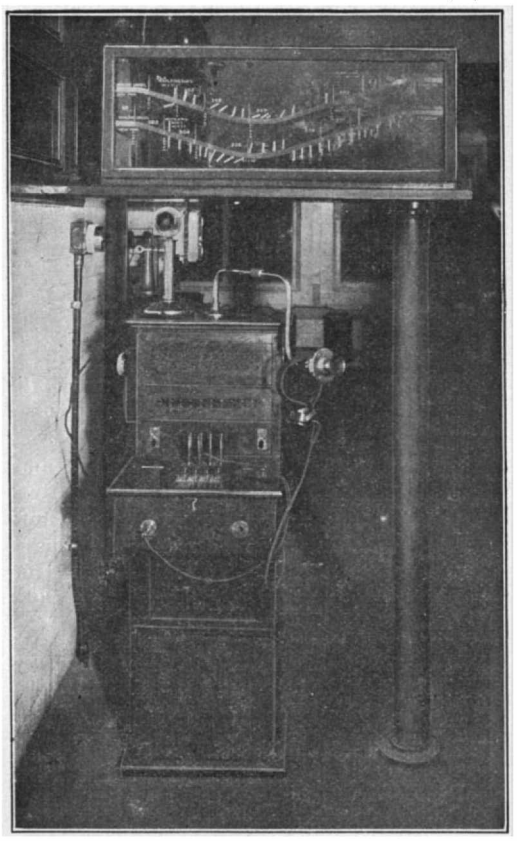
A cylinder with rotating and also axial movement is covered with a sheet of white paper, in the neighborhood of which there is a pencil in connection with an electromagnet. When all is so adjusted that the current strength remains unvaried (as long as the intensity of the light is the same on all the selenium squares) every closing of the circuit causes the pencil to make a stroke, the strength of which corresponds with the stronger or weaker action on the selenium square. The paper is thus covered with a series of strokes of varying strength, which reproduce with considerable approximation the optical image of the object before the camera.

Lime and gypsum in contact with feldspar increase the solubility of potassium. This effect has not been detected when ordinary clay soils are treated in a similar way. This difference is probably due to the absorbing action of the clays which causes the removal of potassium from solutions.

PROTECTING TRAINS UNDER THE EAST RIVER.

BY G. W. MACMURRAY.

When it came to operating trains between New York and Brooklyn under the East River, the management of the Interborough Rapid Transit Company decided still more fully to protect its trains than by the tripping system with fixed blocks, as in use on the express lines in New York. To this end it has installed at the Bowling Green station, where the trains enter the Brooklyn tunnel, a very interesting telltale slate, which shows the positions of the trains in the different blocks. This makes it possible properly to space trains before sending them into the tunnel, and permits the signaling of trains so they can be operated in coming from Brooklyn at a fixed time interval without interfering with the trains to South Ferry, with which they have to be interspersed. The indicator in the Bowling Green tower gives the operator a miniature reproduction of all train movements between Wall Street, New York, and Borough Hall, Brooklyn. The apparatus for reproducing the condition of the tracks under the river, and showing the location of trains passing through from New York to Brooklyn, or the reverse, consists of a box about four feet long, two feet high, and one foot wide with black glass front, behind which are placed colored lights. On the face of this glass are two narrow strips about one-half inch wide, arranged to represent longitudinal sections of each tube under the river. When there are no trains in the tubes, there are green ribbons of light extending from Borough Hall to Bowling Green. Miniature signals in their correct location are placed on this model. When a train enters the tube at either end, the green light is immediately changed to red for the block which that train occupies. This red light follows the position of the train through the tunnel. When a train passes out of a block, the green light is again displayed in its rear. It is also arranged that either track under the river can be used for traffic in reverse direction with safety. When used in this way, the automatic trips will clear up automatically as the train approaches them. The entire control of traffic through the tubes is under the jurisdiction of the Bowling Green operator.



DEVICE FOR INDICATING POSITION OF TRAIN IN TUNNEL.

SHAFT SINKING BY THE FREEZING PROCESS.

BY OUR ENGLISH CORRESPONDENT.

An interesting engineering achievement has recently been brought to a successful issue upon the northeastern coast of England, whereby two colliery shafts have been sunk to a depth of 484 feet from the surface through water-percolated soil and quicksand by the freezing process. This district comprises one of the richest coal-bearing areas of the United Kingdom, the seams running from a point inland to the coast and extending for a considerable distance beneath the bed of the North Sea. As the coast is approached the coal measures dip considerably, and are covered by a thick strata of Permian Rocks comprising magnesian limestone, marl slates, and yellow, or quick, sand. The difficulties attending the sinking of shafts through such soil are numerous, the greatest being the presence of large pockets of water, which being strongly salt testifies to percolation from the sea, which fact of communication is substantiated by the water rising and falling in the shafts in consonance with the tides.

In 1899 preparations were made for the sinking of two shafts at Dawdon on the eastern land limit of the Durham coal field, the colliery being situated only a short distance from the coastline. The two shafts were each of 20 feet diameter, and were sunk simultaneously. The first shaft was sunk by means of pumps to a depth of 350 feet, and lined to a depth of 320 feet, when operations were stopped until the second shaft had been sunk to the same level, so that progress through the treacherous sand might be carried out simultaneously in both shafts; but when the second shaft had reached a point 200 feet deep, the head of water encountered was found to be in excess of the existing pumping plant, and gave every evidence of increasing in volume as the sand bed was approached. At this juncture over 7,000 gallons of water were being pumped out per minute, and operations were brought to a cessation to consider the expediency of erecting additional pumping machinery, or superseding this method by the freezing system. After prolonged deliberation it was considered that the latter would be the more expeditious and attended with a greater degree of success, and the contract for the undertaking was accordingly handed over, together with the whole of the plant, to Messrs. Gebhardt & Koenig, of Nordhausen, Germany, who have made a specialty of this class of work, and to whom we are indebted for the accompanying illustration and particulars.

In their undertaking this firm undertook to freeze the ground around the shafts into a solid mass to a depth of 484 feet from the surface, which was sufficient to penetrate beyond the treacherous strata, and to maintain it as long as required, subsequently thawing the ice and ground, when the lining or tubing had been completed. The first stage in the process comprised the sinking of the freezing tubes, by which the ground was to be converted into a solid mass. Twenty-eight holes were drilled in a circle 30 feet in diameter. The bore holes were carried down to the required depth of 484 feet and were then lined. For a depth of 130 feet from the surface the lining tube was 9.5 inches in diameter, and for the succeeding 330 feet the lining was 7.5 inches in diameter. Within this tube was inserted an inner lining 6.25 inches in diameter to the total depth, the object of this lining being to keep the bore holes clean and to admit of the easy insertion of the freezing tubes themselves.

The freezing tubes each consisted of an outer tube 5 inches diameter, closed at the bottom and sunk to the entire depth of the borehole. Within this was lowered an inner tube, 2.5 inches in diameter, to a point 33 feet above where the existing tubing had been completed, at which point it was connected with the outer tube by a special type of double nipple. The annular space formed between the inner and outer tubes acted as an insulating chamber, preventing any direct communication with the ground and protecting the tubing from the effects of the severe cold. At a point midway between the double nipple and the bottom of the tube in each hole an expansion joint was placed. A third or central tube 1.25 inches in diameter was then inserted. This was open at its lower end, and was lowered until about three feet from the bottom of the borehole. This work completed, the borehole lining tubes were withdrawn, and the freezing tubes were coupled up to the brine circulators for freezing the ground.

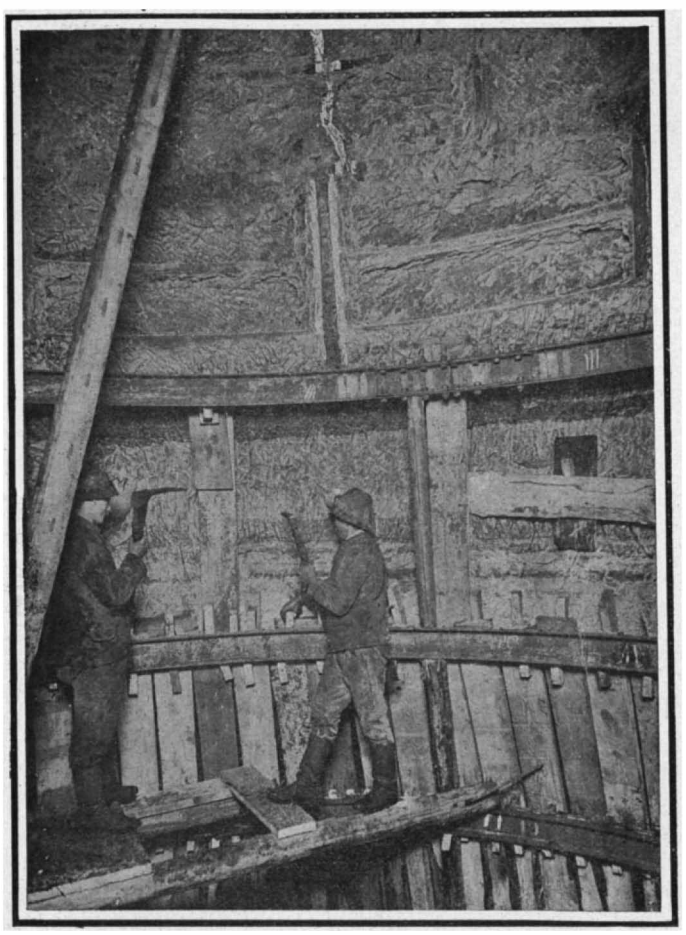
Freezing was carried out by the ordinary ammonia-compressing system, the plant installed being of 2,000,000 British thermal units capacity per hour, there being four compressors driven by two 135-horse-power steam engines. The ammonia was compressed to 150 pounds per square inch and then circulated through the coils of a cooling condenser, of which there were five in all, and liquefied by the extraction of heat caused by the circulation of 14,000 gallons of water per hour. The liquid ammonia then passed to the four refrigerating tanks, containing 10,000 gallons of brine, and subsequently to the compressors for recompression to 150 pounds per square inch. The water for the condensers was pumped from the sea below. The brine consisted of a 26 per cent solution of chloride of magnesia at a temperature of 1.4 deg. F. and was pumped from the refrigerators at a speed of 330 gallons per minute through the sunken freezing tubes circuit and thence back to the refrigerators.

The bottoms of the shafts were filled with concrete, which was found to form an excellent seal to the water feed, and the formation of the ice wall was then carried out expeditiously. When freezing operations were stopped, it was found that in the No. 1 shaft the ice wall was formed for a depth of 40 feet above the concrete around the sides of the shaft, varying from a thin skin at the top to about 3 feet in thickness at the base; while in the second shaft the ice wall was found to be formed to a thickness of 3 feet 6 inches at the bottom. So thoroughly was the ground frozen in the process, that during the freezing of the second shaft, when it was deemed advisable to sink an additional borehole to assist in the operations, the scheme had to be abandoned after a depth of 284 feet had been gained, as the sinking tools became repeatedly frozen in the ground. The time occupied in carrying out the formation of the ice wall was 165 days in the case of No. 1 shaft, and 296 days—owing to several difficulties encountered during operations with the water flow—for No. 2 shaft. In the case of the former the ice wall was maintained 353 days, and in the second instance 186 days for sinking and tubing purposes, giving a total duration of the ice walls of 538 and 578 days respectively.

So solidly was the ground frozen by this means, that the work of excavation within the shafts had to be carried out by blasting, but extreme care had to be exercised in this direction, so that the resultant concussion might not damage the surrounding freezing tubes and thus set up a leakage of brine. Only one shot was discharged at a time. The holes drilled for the insertion of the charges were kept from freezing by using solutions of 6 per cent caustic soda or 10 per cent washing soda. During this stage of operation the workmen had to wear goggles to protect their eyes from flying fragments of rock, and gloves to prevent frost bite.

When the sinking operations and tubing had been completed, the work of thawing the frozen ground commenced. It was essential that this work should be carried out so gradually as not to allow too great a pressure to be brought to bear upon the tubing of the shaft. For this purpose one of the refrigerator tanks was disconnected from the ammonia circuit. To the spiral crest within a steam pipe was connected, and steam passed through the coils, thereby raising the temperature of the brine within the tank, which was then circulated by means of the pump through the freezing tubes. While the warm brine was thus being circulated through the freezing tubes, a brazier of live coke was passed up and down the shaft, so that the air within might be heated and the ice present on the upper lengths of the tubing melted. Thawing occupied a period of 57 and 66 days for shafts 1 and 2 respectively.

The ground once more restored to its original condition, the work of withdrawing the freezing tubes proceeded. For this work a special drawing appliance was utilized, which was lowered into the tube and secured, while upward pressure was imparted to the whole by two hydraulic jacks of 2,581 atmospheres per square inch maximum capacity; but the greatest lifting pressure required at any one hole was 1,355 atmospheres per square inch. As a rule, after a tube had once been "started" by this means, it could be easily withdrawn by means of a steam winch or hand block. The whole task of sinking boreholes, freezing, and thawing the ground to a depth of 484 feet occupied three years.



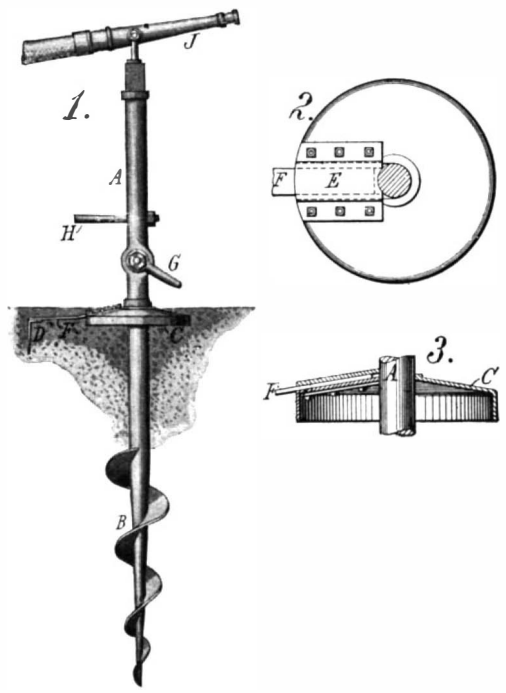
Picking the Ice Wall and Frozen Quicksand.

SHAFT SINKING BY THE FREEZING PROCESS.

Patent Department

SHORE ANCHOR.

For temporarily holding a vessel, raft, or other floating object close to shore it is often found necessary to provide an anchor post, such as shown in the accompanying engraving. The post in the illustration embodies many improvements over the ordinary construction. The main body *A* of the post is formed with a tapered extension *B*, on which is a broad spiral thread, to enable the extension to be screwed into the ground. Mounted on the post is a circular base plate *C*, formed with a downwardly projecting peripheral flange. The plate *C* is radially slotted at one side to permit of the lateral insertion of the post therethrough to the central opening. The slot is closed by a pair of clamping plates *E*, which clamp between them an anchor plate *D*.



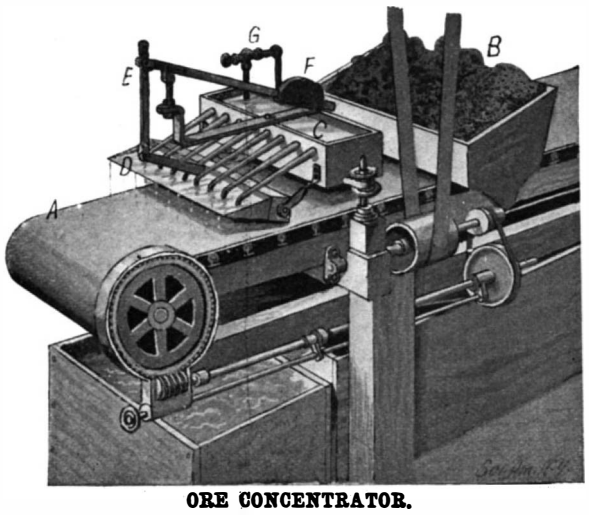
SHORE ANCHOR.

The upper end of the anchor post is squared to receive the wrench used in screwing it into the ground. As the post is screwed in a collar thereon bears against the plate *C*, imbedding it, with the anchor plate *D*, into the ground. A clevis *G* on the post affords means for securing a cable from the vessel. Where a number of anchor posts are used they may be braced together with a coupling bar *H*. Aside from its use for vessels, the post may be employed as a support for temporary or permanent buildings where the soil is loose and easily penetrated, also it is available in hydraulic mining or road bed grading, for which service a swivel connection is used to support a hose nozzle *J*. Mr. John J. Ryan, of 1417 Linden Avenue, Memphis, Tenn., has secured a patent on this anchor.

ORE CONCENTRATOR.

With a view of preventing the fine material from being washed away with the tailings, and thus insuring a complete saving of the concentrates, an ore concentrator has recently been invented in which the water is intermittently applied, permitting the concentrates to pass the impact line undisturbed. The water first washes the concentrates forward, then flowing back down upon the apron washes out the material contained therein.

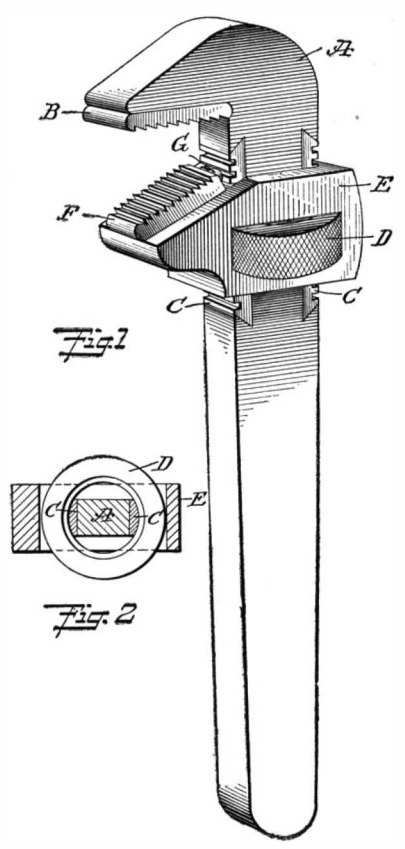
In the accompanying engraving the apron or belt which carries the material to be concentrated is indicated at *A*. The belt inclines upward in the direction of travel, that is, toward the forward end. At *B* is a hopper, which serves to distribute the material onto the belt. In front of the distributor is a reservoir *C*, from which water is fed through a series of chutes to a trough *D*. The latter is journaled in brackets projecting from the reservoir. By means of a link *E* the trough is connected to a lever, which carries the counterweight *F*. Normally, this counterweight serves to keep the trough in position to hold the water that pours in from the reservoir, but when the trough is filled to the brim, the counterweight is overbalanced and the trough is tilted over, spilling the water in a sheet on the belt below. As stated above, such portion of the concentrates as has passed the impact line of the water during the time of filling is washed forward, and then the water flowing smoothly down the inclined apron effectively washes the onward-moving material. In the meantime the trough recovers its normal position immediately, and begins to fill for the next discharge. The inventor of this improved ore concentrator is Mr. Gilbert H. Davidson, of Morenci, Ariz.



ORE CONCENTRATOR.

AN IMPROVED PIPE WRENCH.

The wrench illustrated herewith is formed with a slidable jaw which enables it to grip round surfaces. No retaining pins or other detachable retaining devices are used and an efficient pipe wrench is thus provided with few loose parts. Formed on the main body *A* of the wrench is a fixed jaw *B*. Dovetailed into opposite sides of the body are a pair of detachable racks *C*, which are adapted to mesh with the thread of the nut *D*. This nut is fitted in a frame *E*, which in turn is mounted to slide along the body or shank of the wrench. The frame *E* is extended at one side, and in the inclined upper face of this extension an undercut guideway is formed adapted to receive the slidable jaw *F*. A spring-pressed pin in the jaw bears against the shank *A*, and holds the jaw in its outermost position. In use the nut *D* is adjusted to close the jaws onto the work, and then when the wrench is operated, the sliding jaw moves inward, jamming the work against the upper jaw. Mr. Harvey N. Rothweiler, of Seattle, Wash., is the inventor of this improved pipe wrench.



AN IMPROVED PIPE WRENCH.

Waterproof Mitts.

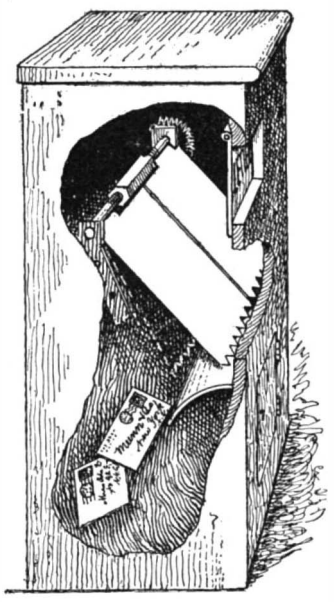
The five- or ten-cent cotton mitts which are so largely bought by workingmen may be waterproofed by dipping them in melted paraffine; or if a thinner coat is preferred, and only on the palm of the mitts, melted paraffine may be brushed over their surface. For handling damp bricks, for working with plaster, or cement, paraffined mitts are far superior to the original. Women will find them valuable when scrubbing floors, setting out plants, and so forth. Leather gloves, for use by farmers in hauling damp corn fodder, or any material that is wet, may be waterproofed in the same way. The coating of paraffine may be renewed as often as the surface needs it. Mitts and gloves—even boots for ditchers—treated with paraffine last longer, because the water can do them little damage. The comfort the wearer experiences by using waterproofed mitts or gloves far outweighs the bother of melting and applying the paraffine.

Lamp Globes for Darning.

A burnt-out electric light globe makes a fine accessory, as a darning tool, to my lady's sewing basket, if the vacuum is first destroyed. To overcome the vacuum, a hole must be made through the base. This can easily be accomplished by a small drill, or even by a stiff wire, or hat-pin. Letting air into the bulb will not prevent its breaking, but does remove all possibility of the unpleasant, if not dangerous effect that might attend the equalization of air pressures should a bulb with a vacuum break in a woman's hands. If the plaster in the base be taken out, a hole sufficiently large is obtained for the insertion of big needles. The bulb thus becomes a convenient receptacle. A mixture of plaster of Paris and fine sawdust may be poured into the bulb if there is no objection to the extra weight. The mixture may be colored; or a pleasing variety can be gotten by sawdusts of dark and light woods intermingled. But this sacrifices the lightness of the bulb, which, when used for darning hose, is highly appreciated by the seamstress.

ATTACHMENT FOR LETTER BOXES.

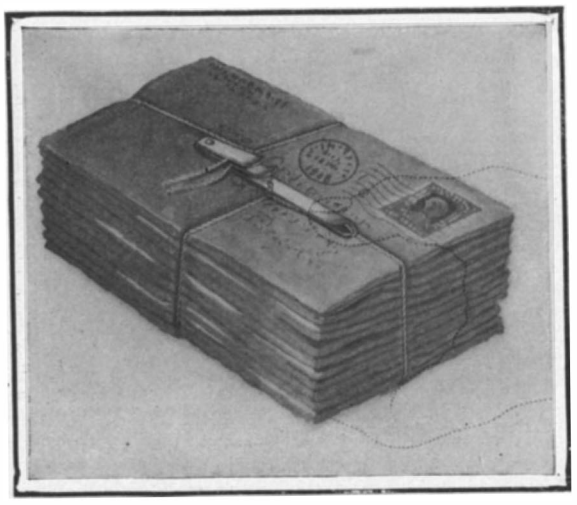
The accompanying engraving illustrates a simple attachment, which may be placed in a letter box to prevent the letters from being removed through the letter slot. It is particularly adapted for boxes that are secured to the doors of rooms or apartments, or in the walls of vestibules. Such boxes are not provided with any safeguards against sneak thieves, and it is an easy matter to rob the boxes by means of long pins or nippers. The attachment consists of a plate mounted within the box, and journaled in brackets secured to the sides of the box. The plate, which for convenience is formed of two leaves, one slidable upon the other, so that it may be lengthened or reduced at will, is inclined forward and downward, and its forward serrated edge normally rests against the front wall of the box below the letter slot. A light spring serves to hold the plate in this position. When a letter is introduced into the box the plate yields before it, and the letter drops onto a deflector plate, immediately below. This serves to throw the letter toward the rear of the box, out of reach from the slot. The play of the swinging plate is limited by a stop pin, so that it can only move far enough to admit the letters. The attachment is the invention of Mr. Eugene A. Cassot, of 503 West 146th Street, New York city.



ATTACHMENT FOR LETTER BOXES.

A SIMPLE PACKAGE TIE.

Pictured in the accompanying engraving is a simple device adapted to facilitate the tying and untying of packages. Although more particularly designed for the use of postmen in tying up packages of letters, its value is not limited to this use alone. The tie is composed of a strip of spring metal which is bent upon itself at one end to form a tongue. Fitted between this tongue and the body of the strip is an intermediate tongue. A rivet passed through the strip and the two tongues serves to hold the latter in place and prevent them from unduly separating. At the opposite end of the strip is an aperture, and an aperture is also formed close to the tongues. A cord is made fast to the tie by knotting it through these apertures. When tying up a package the free ends are respectively carried transversely and longitudinally thereabout, and are caught beneath the tongues. The transverse cord is preferably secured under the upper tongue, and the longitudinal cord is then passed over the other cord and under the intermediate tongue. Thus a binding action is secured which renders remote the possibility of the cords slipping. If desired the cords may be crossed at the underside of the package. When untying the package, both free ends of the cord are simultaneously pulled from under the tongues, freeing the package as easily and quickly as if the cord were cut with scissors. A patent on this improved tie has been secured by Dr. E. L. Sharpe, of Pleasanton, Tex.



A SIMPLE PACKAGE TIE.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

WAIST.—EVA MCG. SHIVELY, Boulder, Col. A purpose of this invention is to provide a waist that is a complete substitute for a corset so far as the appearance of the figure is concerned, and which can be worn without any injurious effects, since no steels, bone, or featherbone are employed, and absolutely no stiff material.

Electrical Devices.

ELECTRIC REGULATOR.—T. M. PUSEY, Kennett Square, Pa. The improvement relates to regulators of the kind used for automatically regulating the voltage and amperage of currents employed for various commercial purposes. It relates further to construction and arrangement of the various parts, whereby the efficiency of the apparatus is greatly increased and the mechanism greatly simplified.

STRAIN-EQUALIZER.—J. W. WASH, Carrollton, Ky. The equalizer embodies details of construction which may be employed to effect equal draft upon a plurality of wires or cables, and particularly to equalize draft strain exerted upon a plurality of telephone or telegraph wires strung overhead upon suitable supports, so that all may be pulled taut by a single rope or chain. It is an improvement on the equalizer formerly patented by Mr. Wash.

MULTIPLE TELEGRAPHONE SYSTEM.—G. MORIN, Habana, Cuba. The more particular object in this case is to provide a number of separate telegraphone disks so arranged that they may be brought successively into action either automatically or by hand, as desired. It further relates to means whereby the various disks may be readily taken out of the machine and replaced by other disks.

TRANSMITTER.—J. T. CURTIS, Bement, Ill. The construction of this transmitter presents quite a number of advantages. The metallic cup is merely sprung into position, which avoids soldering, brazing, or electro-plating, riveting, or using screws. By only using two lugs (at the top and bottom of the transmitter), so as to bind upon the diaphragm at only two points in the circle represented by its outer edge, the sounds are greatly improved. This result comes from the limitation placed upon the movements of the diaphragm being reduced to a minimum and so distributed as to greatly lessen the interference phenomena always present to a greater or lesser extent in the diaphragm.

ELECTRIC SIGNAL SYSTEM.—A. A. BARBERA, Philadelphia, Pa. The system is under the immediate control of a towerman and used in connection with a movable semaphore arm for indicating to the engineer of a moving locomotive the position of the arm, by flashing lamps or energizing an alarm in the cab. In case the arm is disabled, the towerman may transmit to the engineer signals equivalent to those which would be transmitted to him if the arm were in proper working order. Means permit the testing of the electrical connections by the towerman to ascertain their condition.

ELECTRIC MOTOR.—W. SHURTLEFF, Moline, Ill. Mr. Shurtleff's invention is in the nature of a new form of single phase alternating current electric motor, and it consists in the novel construction and arrangement of the poles of the field magnets and windings thereof. The object is to make a strong starting torque and also to provide means for reversing the direction of the rotor.

Of Interest to Farmers.

PEN AND PENCIL HOLDER.—W. R. CRAWFORD, JR., Raleigh, N. C. The purpose in this instance is to provide novel details of construction for a pen and pencil holder, and means for adjustably connecting the holder with suspenders for trousers in a convenient position for ready access thereto as occasion may require.

SEED-PLANTER.—W. F. RODIES, Manchester, Iowa. The improvement has reference to seed planters, and the object of the inventor is to provide a device which will afford means for sowing or planting different kinds of seeds. More specifically, the device is intended to plant corn, and at certain intervals with the corn, pumpkin seeds or seeds of a similar plant.

HAY-LOADER.—A. H. BOSWORTH, Fall River Mills, Cal. This implement elevates hay by the rake that gathers it and the hay is also deposited upon a wagon by the same rake. When the rake is elevated and relieved from the tension of its hoisting cables, it will be automatically started upon its return movement, and the steering can be controlled by the movement of a single lever.

FERTILIZER-DISTRIBUTER.—H. N. HARPER, Monroe, La. The invention is an improvement in fertilizer distributers and particularly in that class of such devices adapted to be applied to the rear part of a farm wagon box and to be attached and detached without any change in the construction of the box.

GAGE FOR SEED-PLANTERS AND CLAMPING MEANS THEREFOR.—D. J. MAHONEY, Witoka, Minn. A gage and means for attaching the same regulate the depth to which the runner or furrow opener shall be permitted to enter the soil and also regulate the depth at which seed shall be deposited. The device can be readily applied to or removed from any of the wheel planters commonly in use without changing the same.

CUTTER-BAR FOR HARVESTERS.—W. S. CLARK, Harrisville, W. Va. The improvements are in cutter bars and cutter blades in which the latter are made in sections which are readily removable for sharpening, or replacing when worn or broken, the object of the invention being to produce a bar and appurtenances which shall be strong and one in which no rivets are necessary.

DISK CULTIVATOR.—F. J. LEWIS, Guadaloupe, Cal. Two series of flat disks are arranged in front of the concave disks and serve to resist the side draft of the latter while acting also as circular colters by which the soil is sliced vertically in parallel rows. The concave disks are arranged, like the colters that precede them, in two series, and on separate horizontal shafts, pivoted and adapted to swing horizontally in order that the disks may be set at inclination to the cultivator's line of travel, and thus caused to dislodge more or less soil.

Of General Interest.

CIGARETTE-BOX.—G. B. MOSLEY, Paris, Tex. This simple and convenient box or kit is for use in enabling persons who roll their own cigarettes to carry tobacco, cigarette paper, and matches in such a manner as to preserve the tobacco against the influence of moisture and to promote the operation of preparing the cigarette.

ORE-CONCENTRATOR.—F. E. MCKINLEY, Guthrie, Okla. The invention is an improvement in concentrators for precious metals and for other use in placer mining and for concentrating gold from dry, or almost dry, material by the application of air under pressure to the material; or, if desired, water under pressure may be substituted for air.

COAL-BUNKER FOR MEN-OF-WAR.—H. A. KAUERMANN, 42 Realschulstrasse, Duisburg, Germany. The known methods of arranging men-of-war bunkers show various disadvantages: owing to the great drop, the coal is very much broken; the trimming of the coal in the bunkers is greatly impeded; by opening the bunker-doors the stoke-holes are in great danger of being flooded; the stability of the vessel loses greatly by the coal being taken from the lower bunkers only. The inventor avoids these and other disadvantages.

TURFING-NEEDLE.—S. H. FERRIER, Troy, Ore. The object here is to provide a device, improved especially with respect to means for threading the needle and feeding the silk or thread, for the purpose of inserting loops through the cloth as close as possible. These loops are or may be afterward sheared to form a plush or pile fabric. A gage adjusts depth of stitch, and the device may be threaded quickly and economizes use of silk and is adapted for rapid operation.

PROCESS FOR THE PRODUCTION OF A DIGESTIBLE FLOUR FROM BRAN.—T. SCHLÜTER, JR., Foerderstedt, near Magdeburg, Germany. According to the invention the bran is subjected to the so-called breaking process, for the enlargement of the surface of the bran, so that a flour is obtained which is highly suitable for bread-making and imparts to the bread containing bran converted according to the improvement valuable properties hitherto not present.

BULKHEAD AND JETTY CONSTRUCTION.—J. A. HOWLAND, Sea Bright, and W. H. DE NYSE, Long Branch, N. J. This hydraulic engineering improvement has for its aim the provision of a bulkhead or a jetty construction, more especially designed for use along the coast in harbors, rivers, and other waterways and arranged to form a lasting protection against the ravages of the sea, teredos, and other destructive causes.

SEA-GROIN.—J. A. HOWLAND, Sea Bright, and W. H. DE NYSE, Long Branch, N. J. This invention relates to hydraulic engineering, and its object is to provide a sea groin or like structure designed for use along the coast in harbors, rivers, and other waterways, and arranged to form a permanent structure capable of withstanding the ravages of the waves, teredos and other destructive causes.

HOLDER FOR VIEWING TRANSPARENCIES.—B. J. FALK, New York, N. Y. This invention has reference to certain improvements in holders for use in supporting transparencies in such a position that the light from any suitable source may shine directly thereon, and the image clearly seen in a mirror or other reflector.

CHEESE-COVER.—F. A. VOGT, Anderson, Ind. The cover affords protection to cheese from dust and insects, and also incloses the usual cheese cutter which may remain in place for service as occasion requires, and suspending means are provided for the cover to enable its convenient removal from the cheese when this is desired.

ALBUM.—W. THOMPSON, New York, N. Y. The invention provides a device suitable for inclosing photographic films and such similar articles, whereby the same will be protected from dust and against injury in handling, transport, etc. Further, the construction of two envelops from a single blank of sheet material, as paper; and the provision of a cover for the album, also made of a single piece.

Hardware.

PLUMB AND LEVEL.—F. O. ROURKE, Shawnee, Ohio. This instrument combines in one structure the functions of both a plumb bob and a spirit level and by its novel construction and arrangements of parts provides a very convenient and effective tool for the use of bricklayers, stone masons, carpenters, and for other uses in building operations.

LATCH.—E. KRAFFT, New York, N. Y. The latch is more especially designed for the doors of toilet rooms and places generally where privacy is desired, and is for use in connection with the spindle of the door knob which operates the latter in a manner to indicate whether or not the room is occupied; this operation, however, being entirely under the control of the party on the inside.

Heating and Lighting.

GRATE-BAR.—G. S. SERGEANT, Greensboro, N. C. In the present patent the invention is an improvement in grate bars and has for an object the provision of a novel construction of sectional grate bar in which the bars composed of detachable sections will be united end to end by interlocking means integral with their respective sections.

GAS-LIGHTER.—L. B. PRAHAR, New York, N. Y. The purpose of the inventor is to provide an economic form of portable lighter, in which a flame is created by manually directing alcoholic vapors to a catalytic igniter, in such manner as to effectually prevent the possibility of an explosion or ignition of the vapor in the reservoir or storage chamber of the lighter.

Household Utilities.

STOVEPIPE AND FLUE-STOPPER FASTENER.—L. F. CULVER, Harvey, Ill. The fastener is for use in retaining either the stove pipe in the flue opening or a stopper over the flue when the latter is not in use. Means are provided for preventing the drawing or pushing of the pipe into the flue beyond the required point, and also means adapting fasteners of the same size to be applied to chimneys or flues of varying thickness.

CURTAIN-POLE.—W. B. LITTLE, New York, N. Y. The object of the inventor is to provide a device by means of which curtains and the like can be artistically and effectively hung or draped, and which provides means for drawing the curtains together or for separating them. The pole supports a curtain or the like at a plurality of points, so that the top of the curtain can be held above the curtain pole and conceal the latter from view.

Machines and Mechanical Devices.

FLYING-MACHINE.—A. V. WILSON, Bar Harbor, Me. This invention pertains to improvements in flying machines, the aim being to provide a machine of simple and comparatively inexpensive construction, so arranged that it will operate with or against the wind and that may be readily directed laterally and also up and down.

VIBRATING BED.—J. A. SEEBER, Portland, Ore. In the present patent the invention is an improvement in vibrating beds, and the object of the inventor is to impart a continuous vibration to the bed. By the mechanism provided the cam plate is adjusted with respect to the box whereby to vary the extent of the vibration of the bed.

REGISTERING DEVICE.—F. DE PARIS, Montreal, Quebec, Canada. The purpose here is to provide a mechanical register, adapted for application to electric, gas, or water meters, or for counting the revolutions of any machine on which it may be used as a tachymeter, or for analogous purposes, and to so construct the machine that it will register accurately unit by unit the quantities measured in their passage through a meter.

RESETTING DEVICE FOR ADDING-MACHINES.—J. J. WALSH, Elizabeth, N. J. The object of the invention is to provide a device for adding machines, arranged to permit the user to quickly raise the numeral disks to zero position when desired. It relates to machines such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Walsh.

BOILER-TUBE PRESS.—J. C. TASSEY and J. B. HARRINGTON, Nashville, Tenn. This invention is an improvement in boiler tube presses for pressing boiler tubes into tube sheets. In operation the base block may be revolved followed by a nut to swage or bead the end tube, the turning of the block also operating to revolve the roller carriage, the rollers revolving against the end of the tube in the forming of the bead.

ROTARY STAMP-MILL.—P. J. LONERGAN, Denver, Col. This new stamp mill is of the type in which vertically reciprocating stamps are arranged to operate upon the ore in a subjacent mortar for the purpose of crushing the same preparatory to extracting the valuable metals contained therein. It is capable of being operated either in a small installation by horsepower or equally efficient on a large scale when operated by power.

CALCULATING-MACHINE.—C. L. NELSON, Seattle, Wash. One of the purposes of this invention is to provide a machine that will tabulate, i. e., produce or print in color form the figures added by the mechanism of the machine and produce at the foot of the column the sum total of the figures of the column in a different color of ink than that used to print the individual figures in the column.

AUTOMATIC BUTTON CUTTING AND SHAPING MACHINE.—W. S. WATSON, Memphis, Tenn. The machine is arranged to automatically cut and dress the face of the button and at the same time sever it from the shell. To prevent the button from sticking in the cutting tool the facing tool is used as a punch while sliding the cutting tool up on the facing tool. Convenient and quick removal of the above named worn out or dull tools and replacing the same by proper ones can be done while the machine is running.

WINDOW.—S. U. BARR, New York, N. Y. The window is completely dust proof and air tight, and arranged to permit of opening and closing a sash. The sash can be locked in place in whatever position it is left, that is, open, partly opened or closed. The sash can be conveniently and quickly placed in position in the window frame or removed therefrom for repairs or other purposes. The invention relates to windows such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Barr.

Prime Movers and Their Accessories.

VALVE MECHANISM FOR ENGINES.—A. GOOD, Manhattan, Kan. In the present patent the invention has reference to the improvements in the valve mechanism of reciprocating engines, having in view in a device of this character the provision of novel means for maintaining the speed of the engine substantially uniform.

TIMER.—C. N. ISAACS, Newark, N. J. This invention relates to improvements in timers adapted for use in connection with internal combustion engines, for closing the circuit through the igniter to produce the explosion, and the object is to so construct the timer that he circuit will be closed a substantially uniform length of time for each explosion, irrespective of the speed at which the engine may be running.

Railways and Their Accessories.

CAR-FENDER.—M. BOGUSHEFSKY, New York, N. Y. This fender is such as carried by street railway cars or trolley cars in order to prevent accidents. Its construction comprises a transverse bar normally held in an elevated position above the cradle at or near the ground line, and just before the cradle a movable part is provided which operates automatically to depress the bar and draw the same toward the cradle in a way to throw the body standing before the cradle rearwardly so that it will fall into the cradle.

RAIL-FASTENER.—O. A. HALL, Omaha, Neb. Permanent means are provided for fastening, clamping, and locking a rail in alinement with or to a tie or roadbed without injuring or defacing the tie or roadbed and means for adjustment for different widths of rail bases and widths of gage without defacing or injuring the tie or roadbed or the necessity of providing new ties or bars whenever the rail sizes or widths of track gages are changed; also to allow use of any form of tie or roadbed, such as concrete, composition, metal, wood, etc., which can be set permanently in place and rails renewed or changed as to sizes whenever desired.

Pertaining to Recreation.

AMUSEMENT APPARATUS.—P. BRAEN and J. BRAEN, North Paterson, N. J. The object of the present invention is to provide, in combination with a wheel or similar device, having reversely arranged spiral tracks connecting at the center of the wheel, or other similar device, means for automatically transferring a car or the like to one of the tracks as it is discharged from the other track, whereby the car may be made to repeatedly travel through the wheel as the latter revolves.

Pertaining to Vehicles.

STREET-SWEEPER.—W. S. BEEMAN, Kansas City, Mo. The invention has in view the production of a sweeper carried by and forming a part of a motor vehicle, in which the sweeping mechanism is driven from the vehicle motor. The sweepings are collected and delivered into the vehicle body, the latter being shiftable on the running gear of the machine to carry it to and from a dumping position. The sprinkling is done in advance of the brush, and the brush and connecting mechanisms are raised upon the vehicle body when it is to be thrown out of action.

Designs.

DESIGN FOR A LAP LUNCH-BOARD.—L. VAN PUTTEN, Holland, Mich. The board is square with rounded corners, the lap end being slightly hollowed out to fit the body of the luncher. An ornamental beaded square is in the center.

DESIGN FOR A WATER-HEATER.—W. J. FINN, Scranton, Pa. This design presents a perfectly flat water heater, in the shape of a pear with the stem end cut off about two-fifths. A graceful ornamental pattern about one-half the area of the top is scolloped out of the center.

DESIGN FOR A SHORTHAND NOTE-SHEET.—W. J. GUY, New York, N. Y. This design provides an oblong sheet with waved, dotted and solid lines running across the space from edge to edge, except that the dotted and solid lines end a relatively slight distance from the left-hand edge of the border line of the design.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

HINTS TO CORRESPONDENTS.

Full hints to correspondents were printed at the head of this column in the issue of August 8th, or will be sent by mail on request.

(10850) W. P. says: Will you kindly state if the phenomenon of "ball lightning" described in inclosed article is an established fact, and if so, how scientists explain it? A. The appearance of globe or ball lightning has been recorded too many times by competent observers to deny its occurrence. Prof. Davis, "Elementary Meteorology," page 268, says: "Discharges of atmospheric electricity occasionally take the form of globe lightning, having the appearance of luminous balls, seeming to be a foot or so in diameter, moving at a moderate velocity, and passing about among objects near the ground; remaining visible a number of seconds, and commonly disappearing with an explosion. No satisfactory explanation has been offered for this curious phenomenon." Formerly the possibility of such an occurrence was promptly denied, but now the scientific mind seeks more carefully to find out what is seen than to make what is seen correspond with the accepted notions of people. Whether ball lightning appears is to be determined by careful observation of competent observers. If such people say they have seen it, others will have to accept their testimony, even if no plausible explanation can be found for the appearance.

(10851) M. F. F. asks: 1. How can you lacquer brass, and what is the preparation used to lacquer with? A. Lacquer is prepared from a nice grade of shellac, better from seed lac, by dissolving it in alcohol and adding some other substance to color or harden it. The article must be perfectly clean and should be warmed. The lacquer is applied with a brush. Full and detailed instructions may be found in our "Scientific American Cyclopedia of Receipts," which we send for $5. 2. A friend works in a telegraph office and he says his relays are wound in the same direction on both magnets and a telegraph sounder is wound differently. I think the relay is wound in different directions. Who is right? A. The direction of winding the magnets of a relay is of no consequence. They must, however, be connected so that the current circulates in one direction on one spool and in the other direction through the other spool, so that one pole is plus at the armature and the other is minus. The same is true of a sounder. 3. I made a wireless telegraph and it works very well except when the tapper should knock the filings apart, and this it will not do. Am I using too much current, or what is the matter? A. Perhaps your coherer needs to be tapped harder to knock the filings apart. Perhaps the ends of the plugs are too near together so that the filings are held too tight. You can easily find if less current will make it work better. 4. How many gallons of water will flow out of a pipe in one day with a pressure of 108 pounds and the hole in the pipe 1-16 inch in diameter? A. The theoretical solution gives about one gallon a minute for the flow from the hole in the water pipe you describe. So much depends upon the thickness of the pipe and the condition of the edges of the hole, etc., that this may be far from the real efflux. This can only be determined with correctness by experiment.

(10852) M. L. W. says: 1. Can you advise me or tell me where I may get information in regard to the tides on the Atlantic coast? A. You can perhaps secure information as to the height of tides at all places along the Atlantic coast through the Nautical Almanac Office, Washington, D. C. At least that is the most likely place to inquire. 2. Is there any tide at the equator, and does it increase as you approach the poles? A. The largest tide is directly under the moon as it passes over the sky day by day. The moon may vary from about 28 deg. north latitude to 28 deg. south latitude, hence the highest tides vary in the same way. Farther north there would be slightly lower tides. 3. Does the character of the coast line affect the height of the tide? A. The character of the coast changes the height of the tide very much. A bay like a funnel makes the tide very much higher. An example of this is the Bay of Fundy, where tides of nearly 60 feet occur. 4. Is there any or much tide in the Gulf of Mexico, and if not, why not? A. Narrow bodies of water such as inland seas, lakes, and gulfs have very little tide. There is not space for the formation of a tide. You will find the discussion of the tides in any physical geography. We can send you ' rr's work on the subject for $1.75 by mail.

(10853) G. H. G. says: 1. Magnetism and amount of wire not considered with direct-current dynamo, does amount of current depend on speed or on number of reversals of polarity? A. The current from a direct-current dynamo is determined by Ohm's law, as is the current in any other case of an electric circuit. Amperes are found by dividing the volts by the ohms. The machine is wound to such a resistance that it will give its rated voltage at its designed speed. At this speed the turns of wire in the armature cut the lines of force in the field at the proper rate to produce the volts required. Of course, the polarity of the coils of the armature changes with each change in the direction of the lines of force through the coils. In a multipolar armature adjacent poles are of opposite polarity, and hence the direction of current changes each time a coil passes a pole. Now the ohms of the dynamo are fixed by the winding, and the volts are constant at the proper speed. Hence the number of amperes a dynamo can give is chiefly determined by the resistance of the external circuit, since the internal resistance of the dynamo is always a small quantity. The amperes then vary very nearly with the resistance of the external circuit. At ten times the resistance the amperes will be reduced to one-tenth, and at half the resistance the amperes will be double the former value. 2. If the number of poles in the field is increased and the revolution of the armature decreased by the same proportion, will the results be the same as if no change had been made? A. From the answer to the first question it is evident that if the number of poles in the field is increased, the number of turns of the armature per second may be increased in the same proportion, without changing the voltage, and therefore with the same results as if no change had been made. This is the reason for the existence of the multipolar dynamo. It can be run at a lower speed than the bipolar machine. High voltages with a bipolar dynamo are difficult to obtain. 3. Have you SUPPLEMENTS containing information on the best construction for producing direct current with least speed? Also on the construction of commutator for direct current where multipolar field magnets are used? A. Books on dynamo designs discuss the subject of the proportions of parts to be observed in a machine. We can send you Wiener's for $3; Crocker's new book for $1; his "Electric Lighting," vol. I., Generators, for $3; S. P. Thompson's "Dynamo-Electric Machinery," a very large book, for $15; Hawkins and Wallis's "Dynamo," for $3.

(10854) C. C. H. says: A friend of mine wishes to charge a small storage battery from the alternating current. Aside from the rather expensive mercury arc, do you know if the aluminium-lead or other valve cell is satisfactory for that purpose? Perhaps you have published directions for making, to which you can refer me. A. We have published three descriptions of different electrolytic rectifiers, using aluminium and lead, to give a direct from an alternating current. You will find them in SUPPLEMENT Nos. 1644, 1679, and in the SCIENTIFIC AMERICAN, vol. 97, No. 8. We send these for ten cents each. These rectifiers furnish about half the initial voltage in direct current. They can be recommended when no more efficient rectifiers are to be had.

(10855) J. D. says: 1. What is the difference between the windings of a battery motor and a direct-current 110-volt motor? A. Two electric motors are supposed to have the same power. Power is in watts. Watts are the product of volts and amperes. A battery current is usually one of low voltage, depending upon the number of cells. The other motor supposed has 110 volts. Now, if the watts are the same, it is obvious that the amperes for the battery motor with a few volts must be more than for the motor with a large number of volts. And this is the case. The battery motor has few volts and many amperes, the motor of a 110-volt circuit has few amperes and many volts. To secure many amperes the motor is wound to a low resistance, either by using a coarse wire or few turns of fine wire. The motor on 110 volts is wound with many turns of wire to a high resistance. A. What is the theory of an induction coil? A. The induction coil is a transformer. It takes a current of low voltage and raises it to a high voltage. 3. What are the advantages of a transformer for electric lighting? A. Transformers are used with alternating currents for lighting or power. They change the voltage to the proper value for the work to be done, and allow the right number of amperes to flow.

(10856) H. A. says: 1. How much energy in foot pounds is expended in the sending of a 1-pound skyrocket? A. The energy of any moving body is calculated from the formula $\frac{W V^2}{2 G}$. G is 32.16 feet, W is the weight of the body in pounds, and V is the velocity in feet per second. The result is in foot pounds. From the velocity of the rocket in your question, which you do not state, you can find the energy. 2. How does the distance on lever increase the pressure, i. e., in what proportion is the work done by a pressure of 1 pound on a 2-foot lever to that of the same pressure on a 3-foot lever? A. The effect in a lever varies directly as the distance from the fulcrum at which the pressure is applied. It is found by multiplying the pressure by its distance from the fulcrum. 3. What causes oily rags when laid aside for a short time to take fire? A. Rags take fire when laid aside filled with paint oil because the oil absorbs oxygen from the air. Paint does not dry by evaporation as water does, but by combining with oxygen, thus growing hotter. If this heat is not radiated from the rags, they will in time become hot enough to take fire. 4. Ditto of green hay? A. In the sweating of a mass of green hay or other vegetable matter there is a large growth of mold or other fungi, and this is a process of the combination of oxygen with other materials, similar to combustion. Heat is generated till in some instances a conflagration has resulted.

NEW BOOKS, ETC.

THE SANITATION OF RECREATION CAMPS AND PARKS. By Dr. Harvey B. Bashore, Medical Inspector for Pennsylvania Department of Health. First Edition. New York: John Wiley & Sons, 1908. 12mo.; cloth; xiii+109 pages; 19 illustrations. Price, $1.

The book adds to the list of practical sanitation works written by this author. His experiences in the field in testing potable water and in the proper treatment of refuse, are given in chapters on Location and Construction, Water-supply, Waste-disposal, Camp Surroundings and the Sanitary Care of Parks. These chapters outline the conditions bred by life in the country at or away from the wayside brook or upland creek, and are an aid to sanitary science. The laws for guarding the welfare of the people could be improved from the researches which the author here makes public.

LOCOMOTIVE ENGINE RUNNING AND MANAGEMENT. By Angus Sinclair. New York: John Wiley & Sons. 12mo.; pp. 438; 55 figures. Price, $2.

It is now over fourteen years since the first edition of this book was published, and the time has arrived when it was necessary to rewrite the whole of it or permit "Locomotive Engine Running" to fall into the condition of an ancient story. There probably was no decade in the world's history when engineering of all kinds made so much progress as it did from 1889 to 1899. The science of locomotive engineering has kept pace with the advance movement, and has made a book on the management of the locomotive revised ten years ago a back number. The author's constant endeavor in rewriting the book has been to keep it up to the times, to make it just as modern as the hundred-ton locomotive. It is an admirable work, well illustrated, with many questions and answers.

EXERCISING IN BED. By Sanford Bennett. Illustrated. San Francisco, Cal.: Published by the author, 1907. Price, $1.50.

At the age of fifty the author of this book was physically an old man, worn out, rheumatic, a chronic dyspeptic, and partially bald, with other minor ailments characteristic of age. Eighteen years later, or at the age of sixty-eight, these indications of physical decay have disappeared. Believing that the simple methods by which this unprecedented instance of physical rejuvenation in advanced years has been obtained, he presents this story of an old body made young. The photographs which accompany his text verify his claim to physical rejuvenation. His present condition is due to a system of alternate contractions and relaxations of all of the large muscles of the body supplemented by massage and practised *seriatim* while lying in bed in the early morning. The author believes that the same results can be obtained by anyone who will faithfully and persistently practise the simple system of exercises which he has devised. Starting with the premise that the real cause of old age is waste-clogging matter, the debris or ashes resulting from the process of life, Mr. Bennett believes in the mechanical or muscular removal of the debris. He argues that any muscle exercised, that is, alternately contracted and relaxed, throws off dead matter and increases in size, strength, and elasticity, and any adjacent gland or organ shares in the improvement.

LIQUID AND GASEOUS FUELS AND THE PART THEY PLAY IN MODERN POWER PRODUCTION. By Vivian B. Lewes, F.I.C., F.C.S. New York: D. Van Nostrand Company, 1907. 12mo.; pp. 334. Price, $2.

The author has an international reputation as an authority on gas as an illuminant and fuel. The subject of liquid or gaseous fuels has, during the last decade, assumed such importance that there is ample room for a good book on this subject. The development of the internal-combustion motor, the perfection of the automobile, and the important part played by liquid fuel in the navies of the world make the present time one of the most interesting epochs in the history of power production; and it is thought that by bringing together the history and practical development of the use of various forms of combustible liquids and gases for the generation of energy, this book may do some service in the advancement of the subject. The author has performed a signal service in bringing out this book at the present time. It is well illustrated with new engravings.

HEALTH AND BEAUTY. By John V. Shoemaker, LL.D., M.D. Philadelphia: F. A. Davis Company, 1908. 8vo.; pp. 476. Price, $3 net.

Health and beauty are closely allied, and nowhere so clearly as in the condition of the skin, pure skin being an important element of beauty as well as of health. It should, therefore, be a subject of much interest to mankind. The author points out to the reader the various methods by which the health may be influenced by climate, diet, ventilation, bathing, and exercising. The diseases to which the hair and nails are also subject receive attention. The legitimate employment of cosmetics is defined and choice formulæ are given for their preparation. This work, although written from a medical standpoint, does not overlook but expressly includes æsthetic conditions which nature itself presents in connection with the subject.

ROAD PRESERVATION AND DUST PREVENTION. By William Pierson Judson. New York: The Engineering News Book Department, 1908. 6x9 in.; pp. 144; 16 illustrations. Price, $1.50 net.

The preservation of the surface and the prevention of dust on macadamized roads form the problem now to be solved by engineers charged with the maintenance of many thousands of miles of broken-stone roads which have been built throughout the country during the past decade. The advent of the automobile increased the acuteness of this problem, and new roads that are proposed or in progress must be better built than the older ones. They must be better bonded and better surfaced and these results must be reached if possible without unduly increasing the cost. The author has given us a most illuminating treatise on the whole subject.

HYDRO-ELECTRIC PRACTICE. By H. A. E. C. von Schon. Philadelphia: The J. B. Lippincott Company, 1908. 4to.; pp. 382. Price, $6.

A comprehensive work, in which the utilization of water power as a source of electric energy is presented. The book is in two parts: 1. Analysis of a Hydro-Electric Project. 2. Designing and Constructing the Plant. The author has pursued the practice of hydro-electric engineering for some fifteen years, and he stands probably alone in his profession in this country as a purely hydro-electric engineer. His exceptional opportunities to gather experience have particularly fitted him to discuss a subject that is now receiving considerable attention from engineers, capitalists, and promoters.

INDIA RUBBER AND ITS MANUFACTURE. By Hubert L. Terry, F.I.C. New York: D. Van Nostrand Company, 1907. 12mo.; pp. 294. Price, $2 net.

The largely extended use in recent years of India-rubber tires on vehicles of all sorts has led to an increased interest being taken by the general public in the natural history and manufacture of rubber. Moreover, the establishment within the last year or two of numerous rubber plantations in Ceylon, the Straits Settlements, and Malaya has led to this almost indispensable commodity becoming a common topic of conversation. The present volume, which is expressly designed for the general reader and for the technologist in other branches of industry, cannot be considered a superfluity—that is, if its scheme of bringing information up to date is considered by the critical reader to have been accomplished. It may be as well to state emphatically that while this small volume does not pose as a working guide or handbook for the India-rubber manufacturer, it is hoped that the latter may find something to interest him in its pages.

MECHANICAL ENGINEERING AND MACHINE SHOP PRACTICE. By Stanley H. Moore. New York: Hill Publishing Company, 1908. 8vo.; pp. 502. Price, $4 net.

This book deals with modern machine shop practice and its correlative mechanical engineering and is written primarily as a textbook for the student and apprentice. The book is profusely illustrated with half-tone engravings, line cuts, and diagrams. The tables are also numerous. It is one of the best works on the subject which have ever come to our attention. It would prove of great value to those who are taking a course in mechanical engineering in some institution of learning. The book is extremely well made and does the publishers great credit.

THE MANUFACTURE OF LUBRICANTS, SHOE POLISHES, AND LEATHER DRESSINGS. By Richard Brunner. Translated from the Sixth (enlarged) German Edition, by Charles Salter. London: Scott Greenwood & Son. New York: D. Van Nostrand Company, 1906. 12mo.; cloth; 176 pages, 10 illustrations. Price, $3 net.

Fatty, chemical, and mineral lubricants are technically and chemically treated in this new edition. Such recipes as are a success in practice have been sanctioned, and they are calculated to give the makers of lubricants for their own uses a reliable compound. Part I. is concerned with the manufacture of lubricants and greases, Part II. with shoe polishes and leather-softening preparations. The rules laid down will secure the perfect preservation of machine parts and protect leather from liability of brittleness. There is hardly an industrial business that may not be benefited by the use of the information and formulæ in this important issue. A substantial index is provided.

MACHINE DESIGN, CONSTRUCTION, AND DRAWING. A Text-Book for the Use of Young Engineers. By Henry J. Spooner, C.E. London: Longmans, Green & Co. New York, Bombay, and Calcutta, 1908. 8vo.; cloth; 691 pages, 86 tables, and over 1,400 figures. Price, $3.50.

Young engineers will find this volume essential in helping them to a thorough training in the elements and principles of design. The opening chapters are given to teaching the art of making working drawings of simple pieces, while design and construction more particularly claim the author's attention in the remainder of this highly technical work. At the end of most of the chapters, drawing and sketching exercises are furnished. Useful

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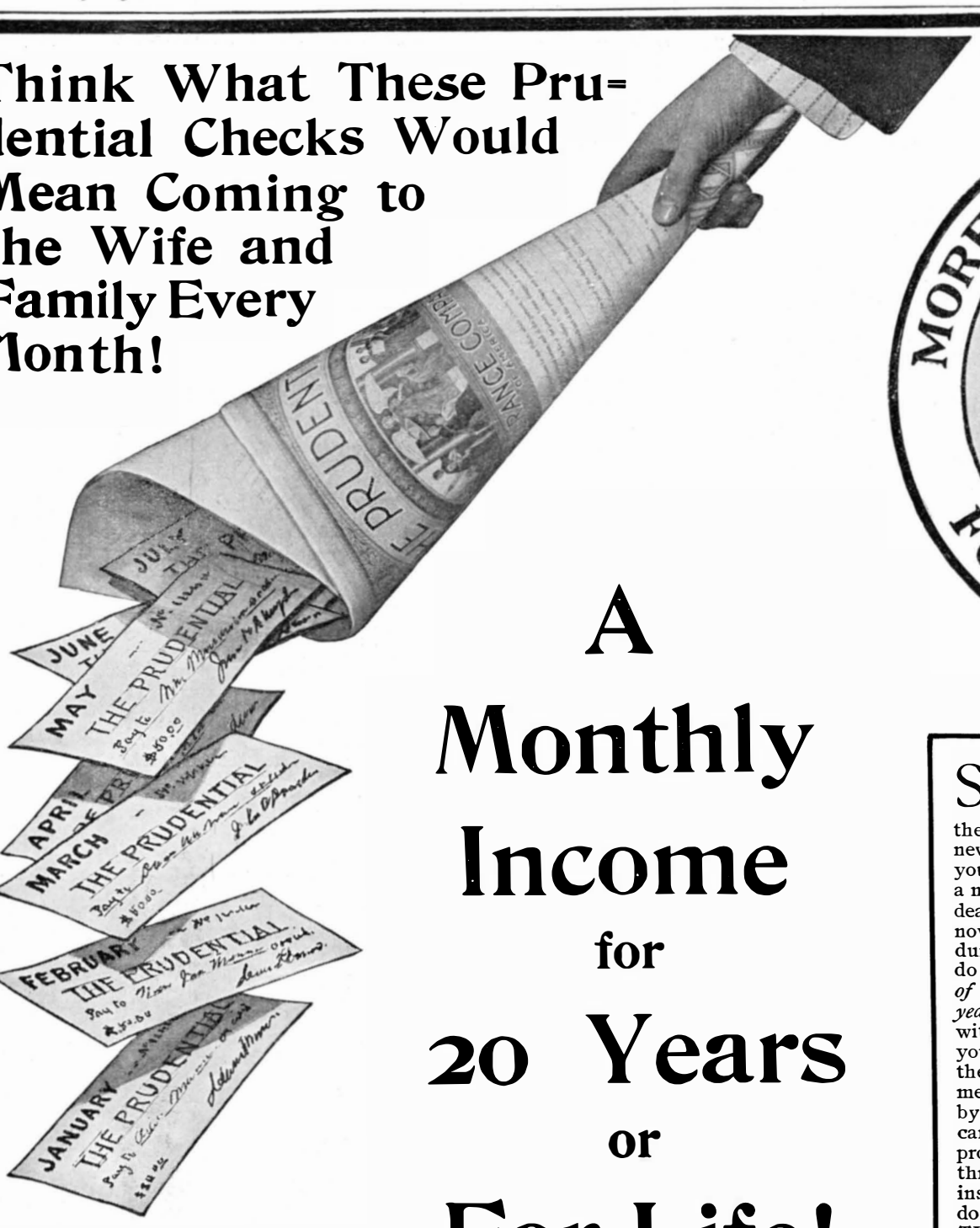

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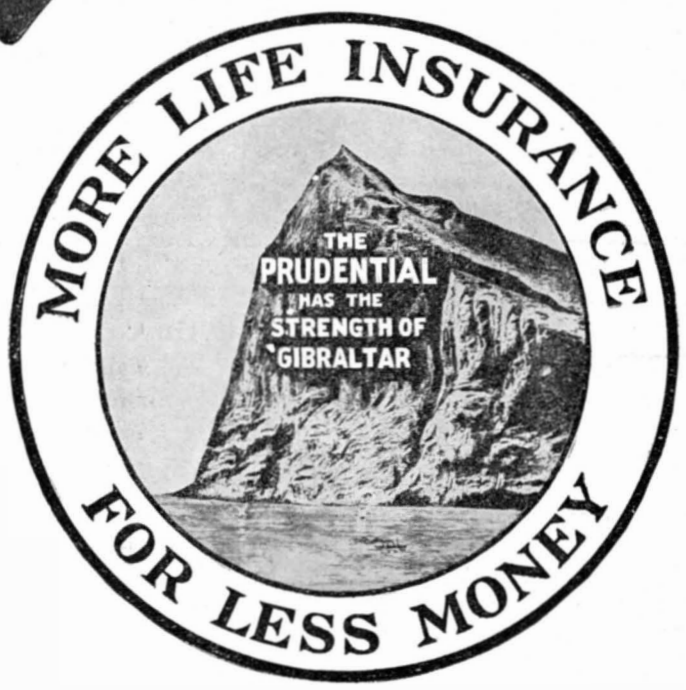

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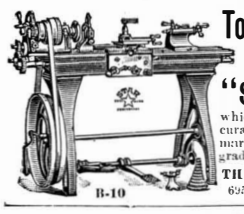

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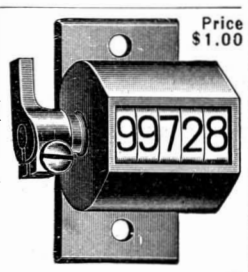

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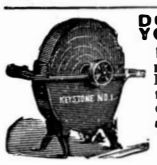

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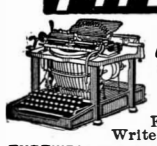

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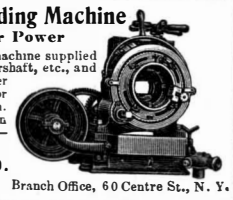

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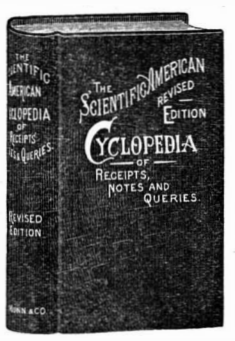

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Stories for the November Fiction Number, by Rex E. Beach, Rowland Thomas, and O. Henry, will be announced next month

Collier's

The National Weekly

Horse checking and unchecking apparatus, H. A. Clemens 897,875
Hose and pipe coupling, W. Eisenmann 898,199
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Inquiry No. 8842.—Wanted to buy annealed glass.

Inquiry No. 8843.—Wanted to buy cigarette making machine.

Inquiry No. 8844.—Wanted to buy inkstands.

Inquiry No. 8845.—Wanted to buy mail order novelties, books, etc.

Inquiry No. 8846.—Wanted to buy an electric butcher hand saw.

Inquiry No. 8847.—Wanted laundry tubs.

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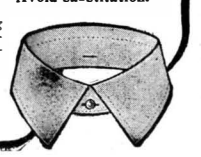

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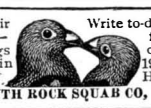

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"Queen Alexandrias of Judea Sweet-Violet-Bath Powder," for a bath powder, J. L. De Zeabault ... 14,345
"School Boys Useful School Article U. S. A. Pencil Case," for pencil case, E. Pearl .. 14,349
"Soul Kisses," for confections, Huyler's ... 14,342

PRINTS.

"Cleaning a Drawing," for a cleaning composition, A. Sommer ... 2,333
"Cleaning a Glove," for a cleaning composition, A. Sommer ... 2,334
"Cleaning a Hat," for a cleaning composition, A. Sommer ... 2,335
"Cleaning a Slipper," for a cleaning composition, A. Sommer ... 2,337
"Cleaning the Wallpaper," for a cleaning composition, A. Sommer ... 2,336
"Compass and Lead Backs, Columbia Playing Cards," for playing cards, United States Playing Card Co. ... 2,338
"French Auto Oils," for lubricating oil, Marshall Oil Co. ... 2,332
"Panama Souvenir Playing Cards," for playing cards, United States Playing Card Co. 2,339
"Stevens Rifles, The Bull's Eye Kind," for rifles, Milton Bradley Co. ... 2,341
"Table for Grinding Clearance," for cutter grinders, R. K. le Blond Machine Tool Co. 2,340
"The Pirate," for a wheat breakfast food, Cream of Wheat Co. ... 2,331

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

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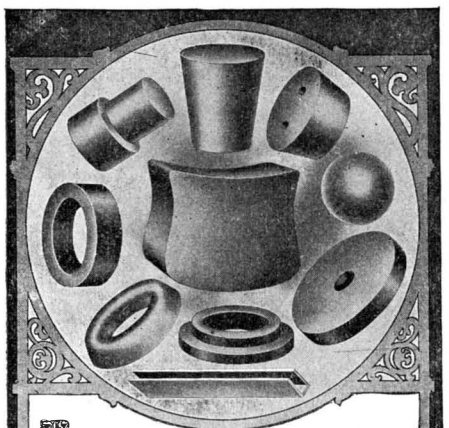

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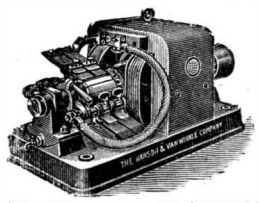

An important decision has just been rendered by Judge Cross of the Circuit Court of the United States, District of New Jersey in favor of the Hanson & Van Winkle Co., of Newark, N. J., and Chicago, Ill., and against the United States Electro-Galvanizing Company, of Brooklyn, New York, for a new process of electro-galvanizing.

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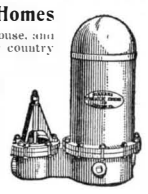

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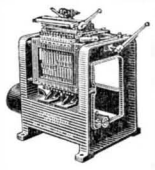

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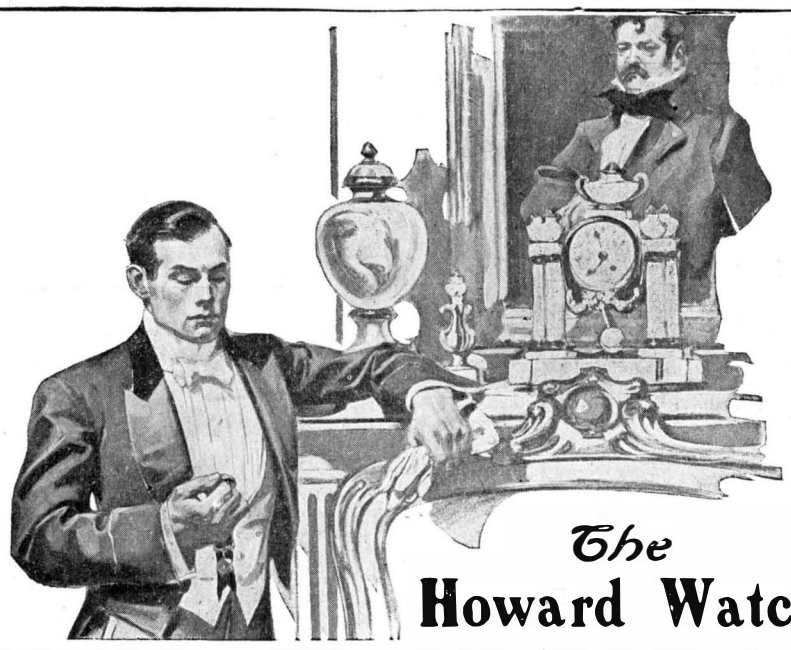

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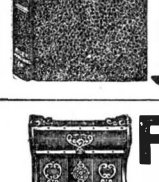

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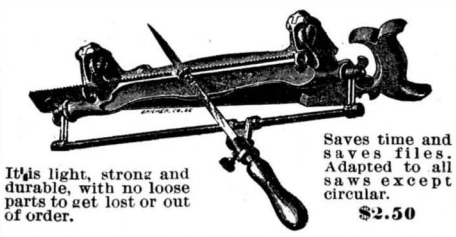

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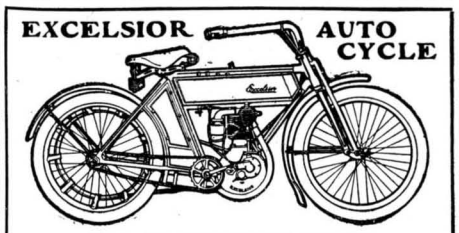

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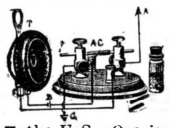

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